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Book of Abstracts

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A012: High Energy Physics (Poster) / 622**Effect of the K^+ in-medium potential on K^+ production in heavy ion collisions**

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K^+ meson production in nucleus-nucleus collisions at energies near the kaon production threshold energy were investigated within the quantum molecular dynamics (QMD) model based on the co-variant kaon dynamics. We analyzed the rapidity dependence of the direct flow v_1 and the elliptic flow v_2 of K^+ meson, and the transverse momentum (p_T) dependence of v_1 for the K^+ meson in Ni + Ni collisions at 1.91 A GeV, and compared the results with the FOPI data. The cross section of K^+ production as a function of the laboratory momentum in polar angles 32° , 40° , 48° , and 60° , respectively, from Au + Au collisions at incident energy 1.5 A GeV, Ni + Ni collisions at incident energy 1.93 A GeV and C + C collisions at incident energy 1.8 A GeV were also analyzed and compared to the KaoS data. We observed that the kaon in-medium potential obviously affects the K^+ production in nucleus nucleus collisions. After taking into account the K^+ in-medium potential and using the soft equation of state, the theoretical results are in good agreement with the experimental data.

A012: High Energy Physics (Poster) / 524**Cosmic-Ray Muons Detection by a Spark Chamber**

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Cosmic ray, originating from several galactic sources, bombards the Earth's atmosphere and produces lots of secondary particles. One of them is an unstable charged particle known as "muon (\pm)" with speed close to the speed of light and lifetime about 2.2 microseconds before decaying into others. In this study, a spark chamber detector with 10 stacks of parallel electrode plates is constructed to detect the cosmic-ray muons which will lose their energies via ionization in the helium filled chamber. When muons passing through the chamber, they left their traces as the ionization paths. Sparks will occur immediately between each stack of parallel electrodes which are connected to a high voltage supply. The muon's trajectory then can be visualized by connecting the sparks in each stack. To reconstruct this muon's path, two cameras are set to record the events from the two perpendicular planes on two sides of the chamber. The photos are analyzed using MATLAB to obtain the coordinates of the sparking tracks which then are used to determine the zenith angular distribution. The results show that a large number of muons arrived at our laboratory (Chulalongkorn University, Bangkok, Thailand $13^\circ 44' 09.5''\text{N}$ $100^\circ 31' 49.6''\text{E}$) with a zenith angle about 30° .

A012: High Energy Physics (Poster) / 496

Silicon sensor design with TCAD simulation

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The Technology Computer Aid Design (TCAD) is a simulation framework of semiconductor processing, device operation and interconnect characterization for technology development and manufacturing. The collaboration between Suranaree University of Technology (SUT) and Thai Microelectronics Center (TMEC) aims to design a sensor prototype for particle tracking. The TCAD software at TMEC is used to simulate a semiconductor diode which is placed into this sensor. In this work, device operation as part of the TCAD is used to simulate TMEC's power diode (P⁺N⁻N⁺ diode). As an input parameter, we import a Spreading Resistivity Profile (SRP) as a diode model structure into the TCAD software. In the SRP, the doping concentrations of P⁺ and N⁻ layers are around 10¹⁸ cm⁻³ and 10¹⁴ cm⁻³, respectively. In the N⁺ layer, however, the concentration cannot be measured due to a limited depth of the SRP. Experimental data from the Electrical Characteristics Measurement (current, capacity) is compared to simulation results from the TCAD. We find that current, as well as capacity obtained from our simulation, are in good agreement with the experimental measurements.

A012: High Energy Physics (Poster) / 482

Commissioning status of the 1 GeV electron beam test facility (BTF) at Synchrotron Light Research Institute (SLRI)

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The Collaboration between A Large Ion Collider Experiment (ALICE), Suranaree University of Technology (SUT) and Synchrotron Light Research Institute (SLRI) have been established to characterize pixel sensors for high energy particle detectors. Under this collaboration, the Synchrotron Light Research Institute (SLRI) - Beam Test Facility (BTF) has been designed and installed to the SLRI accelerator complex. A tungsten wedge target has been carefully designed to reduce the high intensity electron beam for the sensor and detector characterisation purposes. SLRI-BTF provides 1 GeV electron beam (tunable) with a few electrons per burst and the repetition rate of 0.5 Hz. The reference telescope consisting of 7 planes based on the ALICE Monolithic Active Pixel Sensors (MAPS) prototype, pALPIDE, has been set up at the experimental station to measure the sensor tracking detection efficiency.

Keywords: The Synchrotron Light Research Institute (SLRI) - Beam Test Facility (BTF), A number of cluster, An ALICE pixel detector (ALPIDE)

A012: High Energy Physics (Poster) / 589

Yukawa scattering treated by the Quantum dynamical principle

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Yukawa scattering is pedagogically interpreted, by the Schwinger's quantum dynamical principle involving the generating function, which is replaced by a functional differential operation. As for the results, we get the asymptotically free Green function that explains the behavior of the Yukawa potential when the mass parameter is increasing. And it can also lead to scattering amplitude and differential cross section respectively.

A013: Materials Physics (Poster) / 697

NO₂-BDC as sensitizer and photoluminescence properties of [(La)(NO₂-BDC)₃(H₂O)₄] and [(La_xLn_y)(NO₂-BDC)₃(H₂O)₄] (Ln = Eu, Tb)

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Following our interest in photoluminescence properties of lanthanide coordination polymers constructed using 2-nitro-1,4-benzenedicarboxylate (NO₂-BDC²⁻ [1,2], the lanthanum and its europium and terbium doped samples have been prepared; [(La)(NO₂-BDC)₃(H₂O)₄] (1), [(La_{0.92}Eu_{0.08})(NO₂-BDC)₃(H₂O)₄] (2), [(La_{0.92}Tb_{0.08})(NO₂-BDC)₃(H₂O)₄] (3). According to the powder x-ray diffraction, 1-3 are isostructural exhibiting a dense 3D framework structures. Photoluminescence of the three samples were investigated among which only blue emission due to the intra-ligand fluorescence was found for 1 with the excitation at 337 nm. The doped samples 2 and 3 emitted the characteristic *f-f* transitions at the same excitation wavelength; ⁵D₀-⁷F_{*j*} (*j* = 1, 2, 3, 4) at 588, 617, 672 and 693 nm for 2, and ⁵D₄-⁷F_{*j*} (*j* = 6, 5, 4, 3) at 488, 545, 586 and 620 nm for 3. Temperature dependent photoluminescence properties of 2 (Eu^{III}; ⁵D₀-⁷F₂) and 3 (Tb^{III}; ⁵D₄-⁷F₅) have been investigated in term of intensity, revealing significant difference in the Eu^{III} and Tb^{III} centered emissions in 333(2)-393(2)K range. The observed thermal responsive *f-f* transitions of the doped samples is discussed.

A013: Materials Physics (Poster) / 736

Properties of SrTiO₃ ceramics synthesis by Hybrid method

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The SrTiO₃ ceramics were fabricated by sol-gel and solid-state reaction hybrid method. The powders synthesized at the SG:SR molar ratio of 0.1:1 calcined at 950°C for 2 hours were used to prepare the ceramics which were after sintered at 1050, 1150, 1250, and 1350°C. The crystal structures, morphologies and dielectric properties of the ceramics were subsequently characterized. The pure cubic perovskite phase of SrTiO₃ corresponding to JCPDS number 35-0734, was revealed by X-ray diffraction (XRD) in every studied sintering condition. Scanning electron microscope showed the increase in average grain sizes when raising sintering temperatures. The grains were approximately spherical with the sizes ranging from 0.20 to 1.07 μm. The highest dielectric constant, found in the ceramic sintered at 1350°C for 2 hours was 441 (at 1 kHz).

A013: Materials Physics (Poster) / 737

Synthesis of Ba_{0.7}Sr_{0.3}TiO₃ ceramics via hybrid method

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Barium strontium titanate (BST) ceramics were prepared by the hybrid method between solid-state reaction (SR) and sol-gel combustion (SC) methods using urea as a fuel. The crystalline powders were prepared by the mixed precursors at SR:SC molar ratio of 1:0.3 calcined at 950°C for 2 hours. The BST ceramics were made of the calcined powders by sintering at 1050-1350°C and instigated the crystal structures by XRD. In every ceramic sample, a pure perovskite structure corresponding to JCPDS no. 34-0411 was detected. SEM revealed an increase in a grain size when a temperature increased. The highest dielectric constant 11580 was found in the sample prepared at 1350°C for 4 hours with dielectric loss of 0.007.

A013: Materials Physics (Poster) / 789

Effect of Heat Treatment on Spectroscopic Properties of Tanzanite

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Tanzanite is blue to violet gem variety of mineral zoisite. It is a very popular jewelry gemstone in gems trade. Due to the unique beautiful color of tanzanite is rarely natural; almost tanzanites are usually has been heat-treated to enhance the beautiful color. In this research, color enhancement of natural tanzanite from Tanzania was performed by heat treatment and its spectroscopic characterization was determined. The stones were heat-treated in an atmosphere with the heating temperatures at 400, 500 and 600°C, soaked for 2 hours. Basic gemological equipment was applied to identify the unheated and heated tanzanite sample. In order to study the color change of tanzanite after heat treatment, colors and color differences were measured and evaluated using CIELAB color measurement. The cause of color change and chemical behavior of tanzanite were studied by energy-dispersive X-ray fluorescence spectrometry, UV-visible spectroscopy and diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy. The results of color change and spectral properties may be utilized to enhance the satisfactory color and identification of heated tanzanite.

A013: Materials Physics (Poster) / 664

An investigation of structural and elastic properties of soda-lime glasses doped with rare earth oxide

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All glass samples in the system (90-x)RWG - 10Na₂O - xNd₂O₃ where the RWG is recycled window glass (where x = 0, 0.1, 0.25, 0.5, 0.75 and 1 in mol% respectively). The glass samples were prepared by using melt quenching method. The elastic moduli were studied by measurement ultrasonic velocities using pulse echo technique. The structural properties of the glass samples were investigated using infrared absorption spectroscopy. The results illustrate that increase of Nd₂O₃ content lead to the distorted glass network, which brings to the decrease of rigidity of glass network. In addition, the FTIR spectra was supported the ultrasonic result.

A013: Materials Physics (Poster) / 739

Effect of Sulfuric Acid Treatment for ZnO Photoelectrode on Photovoltaic Properties of Dye-sensitized Solar Cell

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This work mentions a surface treatment of ZnO film by sulfuric acid solution. The ZnO film was prepared from commercial ZnO nanoparticles using screen printing method. The ZnO film was vertically dipped into diluted sulfuric acid solution for different treatment times. Morphology of the treated ZnO film shows small different change. The treated ZnO film was used as photoelectrode of dye-sensitized solar cell and photovoltaic characteristic was measured. Maximum power conversion efficiency is observed for the dye-sensitized solar cell fabricated with treated ZnO film. It reveals a quite higher than PCE of dye-sensitized solar cell fabricated with the non-treated ZnO film. The efficiency enhancement of dye-sensitized solar cell is due to the increased open-circuit voltage and the fill factor even through the decrease of current density is appeared. The effect is a result of the improved internal resistance.

A013: Materials Physics (Poster) / 743

Annealing Effects on Morphology and Microstructure of IrMn Thin Films

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Recently, IrMn alloy were used as coupled layer with a ferromagnetic layer to increase sensitivity in magnetic sensing for magnetic data storage because this film can maintain high exchange bias strength even with ultra-thin layer. IrMn thin films were grown by magnetron sputtering technique. The films contained the face center cubic structure with Mn concentration in range of 65-80 wt.%. These films were annealed at different temperatures in Ar atmosphere and air. The surface of as-deposited film showed smooth surface and contained small grains. After annealing, Mn-oxide can be detected on the surface and exhibited subordinated peaks between 300-400 cm^{-1} and main peak at 662 cm^{-1} which match to Mn_3O_4 . Nevertheless, XRD results in as-deposited film shows two main peaks of this film which are (111) and (200). Lattice constant of IrMn is 3.76 Å. Meanwhile, lattice constant of annealing film was slightly decrease. Furthermore, the annealing temperature became significant factors to the formation of Mn-oxide of IrMn material. The effects of annealing temperature on the formation of Mn-Oxide and microstructure will be discussed during the presentation.

A013: Materials Physics (Poster) / 753

Fabrication of Electrode Supercapacitors with Carbon Powders Material Synthesized from Different Wood

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The fabrication of supercapacitors electrode with carbon powders material synthesized different wood such as of Broken Bone tree wood, Rain Tree wood, Kapok wood, Bitter bush wood, macrophyllus wood, Copper pod wood, Black Siris wood and Iron wood. Carbon powders from physical activation were prepared at 1000 °C for 2 hrs under flowing argon. The structural properties, morphological and quantitative analysis of Carbon powders were investigated by X-ray Diffraction (XRD), Energy Dispersive X-ray Spectroscopy (EDX) and Field Emission Scanning Electron Microscope (FE-SEM). The Electrical properties of supercapacitors were measured by the charging and discharging (C.D). The carbon powder from physical activation at 1000 C for 2 hrs under flowing argon has a characteristic black powder with a different size and hardness. The carbon powder revealed amorphous structure with position peaks of graphite plane of (002) and (101) at 2θ of 26o and 44 o. The morphology of carbon powder will have a broken appearance, which has an uneven size, and each type has a different rough surface, resulting in a different porous. The quantitative analysis this shows the dispersion of carbon elements, which are well dispersed and have a high amount of carbon 99% by weight. The discharge and discharge process as the specific capacitance value of the supercapacitor was measured from carbon powder material synthesized from different wood. The specific capacitance value of the supercapacitor using carbon powder material synthesized from different corresponding to highest specific capacitance value has as high as of 4.03 F/g at the current of 50 mA.

A013: Materials Physics (Poster) / 771

Mechanical Properties of Astaloy 85Mo and Astaloy CrM containing Manganese

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In this work, the usage of manganese (Mn) as an inexpensive alloying element for ferrous powder metallurgy was investigated. The mechanical properties of sintered Astaloy 85Mo and Astaloy CrM with different Mn and carbon (C) content were compared. Ferromanganese (FeMn) 1.25% and 2.5% and graphite 0.2%, 0.4%, and 0.6% by weight were mixed with Astaloy 85Mo and Astaloy CrM. The change of microstructure from the increasing Mn and C content can enhance the mechanical properties of sintered Astaloy 85Mo and Astaloy CrM. However, the distribution of Mn in the samples was extremely dependent on other alloying elements. The uniform distribution of Mn in Astaloy CrM resulted in the improved mechanical properties.

A013: Materials Physics (Poster) / 782

Textile Gas Sensor based PANi/PEDOT:PSS Coated on Cotton Yarn for Ammonia Detection

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In this work, we report the textile-based gas sensor for ammonia (NH₃) detection using PANi/PEDOT:PSS coated on commercially cotton yarn. A layer-by-layer of textile-based gas sensor was prepared by a facile dip coating of poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) on the cotton yarn surface followed by coating a layer of polyaniline emeraldine base (PANi) on the top of the device. For this device structure, the PEDOT:PSS was proposed as a hole transport layer, while the PANi acted as a sensitive layer. The PANi/PEDOT:PSS sensor exhibits a low base resistance $\approx 5 \text{ k}\Omega$ and good sensing response to NH₃ gas at room temperature. In comparison to PEDOT:PSS sensor, the PANi/PEDOT:PSS sensor has higher sensing response with faster response and recovery times. Moreover, the device shows approximately linear increase as NH₃ gas concentration was increased. These results indicate that this proposed sensing device structure is possible to apply as an environment ammonia monitoring.

A013: Materials Physics (Poster) / 784

Improved phase transformation and dielectric constant of P(VDF-HFP) fiber by doping with AlCl₃·6H₂O filler

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This research aims to prepare the polyvinylidene fluoride-hexafluoropropylene (P(VDF-HFP)) fibers by electrospinning process with different electric fields. The aluminium chloride hexahydrate ($\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$) was filled into the fibers to act as nucleating agent for β phase transformation. The morphology and phase transformation of the neat fiber mats with and without $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ were investigated by scanning electron microscopy and Fourier infrared transformation. The results show that the average diameter of fibers decreases with increasing electric field. The diameter of composite fiber becomes smaller compared to that of the pure P(VDF-HFP) fiber. The β phase fraction of fiber mats increases due to the applied electric field and $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ filler. Moreover, an improvement of dielectric constant is found in the composite fibers, suggesting for mechanical sensors.

A013: Materials Physics (Poster) / 791

Effect of Fiber Structure on Gas Sensing Properties of Polyaniline Coated on Single Yarn

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In this study, we report the influence of textile substrates upon the behavior of electrical and gas sensing properties of polyaniline (PANi) coated on the commercially single yarn. The sensing devices were prepared by dip coating of PANi on various kinds of yarn structure including cotton, viscose rayon and polyester. Sensor fabrication parameters which included precursor, reagent and acidity doping concentrations have been studied. The results showed that the PANi can easily coated on cotton and viscose rayon yarns as indicated electrical resistance of 28 ± 7 and 47 ± 9 k Ω /cm, respectively, while it hardly coated on polyester substrate as indicated resistance greater than 200 M Ω /cm. The resulting PANi-based textile sensors were found to be highly selective to ammonia gas with linearly dependence on gas concentrations. Furthermore, the sensor can identify level of ammonia gas as low as 5 ppm with fast response time.

A013: Materials Physics (Poster) / 793

High quality nano-silica aerogels prepared by a facile method from bagasse ash under ambient pressure drying

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Nano-silica aerogels were synthesized from sodium silicate which is obtained from the reaction of bagasse ash and NaOH. Silanes and salazane was employed to control the formation and structure of silica aerogels in this study. To initiate the modification of silica aerogel properties, 1.0 M NH_4OH solution was utilized. The silica aerogel resulted from the reaction was dried under ambient pressure at temperature of 85 for 24 h. Results from preliminary experiment showed that silica aerogel

with different surface area was obtained when it is prepared in different solvents and times. Hydrophobic properties of prepared gel is so high (water contact angle, about 120-140°) closed to the super-hydrophobic materials. Specific surface area and pore volume are quite high indicate the success of silica aerogels from biomass under drying at ambient pressure.

Keywords : Silica aerogels, Ambient pressure drying, Bagasse ash, Hydrophobic, Absorbent

A013: Materials Physics (Poster) / 810

Simulation of Magnet Design for Magnetic Refrigeration

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Magnetic refrigeration is a new technology based on the reduction of temperature below the room temperature by magnetocaloric effect. The Comsol mutiphysics and Poisson Superfish program are used to simulate the optimum structure for generating the maximum magnetic flux density in the air gap. A neodymium-iron-boron permanent magnets has a remanent flux density of 1.44 Tesla and relative permeability of 1.05. A soft magnetic material is low-carbon steel for conducting and directing magnetic flux. The magnetic flux density in the air gap is dependent on 1) the area of the soft magnetic material 2) the radius of Halbach cylinder and 3) the magnetic flux density change in angular direction. From the simulation, the magnetic flux density in the 30 mm air gap between the soft magnetic materials is at the optimum when the area of soft magnetic materials us equal to the area of permanent magnet. With the magnetic flux density at the air gap is as high as 1.59 Tesla, this distance is appropriate to design a magnetic refrigerator.

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Simulation of Interaction of Flywheel Rings with Superconducting Bearing for Flywheel Energy Storage Systems

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Excess energy in machinery can be stored for reuse in forms of the kinetic energy of the flywheel, composed of a permanent magnetic ring. In the simulation of interaction of flywheel rings with superconducting bearing with COMSOL Multiphysics version 5.2 program, a Neodymium-Iron-Boron magnetic ring of 20 mm in inner radius, 80 mm in outer radius, and 23 mm in thickness has a remanent magnetic flux density of 1.3 T. An Yttrium Barium Copper Oxide superconducting ring is 20 mm in inner radius, 80 mm in outer radius, and 5 mm in thickness. It is found that the magnetic flux density along the radial direction measured from the center to the edge of the ring is not uniform for every simulation distance. While the magnetic flux density is almost uniform at 80 mm with an exception of the center in the angular direction when the distance from the ring surface increases. The higher values in the range of 0.14-0.34 T is obtained near distance of 5-20 mm. When the dimension of magnetic ring is changed, the repulsive force is reduced. This results indicates that the repulsive force useful for stable flywheel energy storage systems can be enhanced by increasing the dimension of magnetic ring or soft magnetic materials.

A013: Materials Physics (Poster) / 437**SYNTHESIS AND CHARACTERIZATION OF METHYL AMMONIUM LEAD IODIDE BROMIDE PEROVSKITES****Author:** Wipakorn Rittisut¹¹ *student***Corresponding Author:** winzensio@gmail.com

Now, the research field of perovskite based solar cells has recently been developed as the most promising candidate for next-generation because of their high efficiency solar cell technology that is compatible with low-cost, low-temperature processing, long-term stability and simple structure of solar cells production such as the hybrid halide perovskite $\text{CH}_3\text{NH}_3\text{PbI}_3$ in solar cells have high power conversion efficiency exceeding 22%. But, the unstable nature of perovskite was observed when exposing it to continuous moisture, illumination and high temperature obstructing the commercial development in the long run and thus becoming the main problem that needs to be solved immediately. In this work, the preparation of organic – inorganic halide perovskite by mixing halide group between iodide with bromide in this compound, $\text{CH}_3\text{NH}_3\text{PbI}_x\text{Br}_{3-x}$ compound under the annealing temperature condition was investigated. The structure of the product was identified by X-ray diffraction (XRD) and Wide Angle X-ray Scattering (WAXS). In addition, High Resolution TEM was used to study the presence morphology of crystalline domains within the sample. We examine the thermal properties of samples using Thermogravimetric analysis (TGA) and Simultaneous Thermal Analyzer (STA). To check the variation of optical properties in these compound, we measured the UV-visible absorption spectroscopy and X-ray Photoelectron Spectroscopy (XPS) shown the survival of organic group. It is concluded that the annealing affects phase formation and thermal stability of $\text{CH}_3\text{NH}_3\text{PbI}_x\text{Br}_{3-x}$. A small powder amount of lead bromide (PbBr_2), a product of the degradation, was observed with increasing annealing temperature. Accordingly, appropriate annealing temperature should be chosen to produce a high efficiency photovoltaic

A013: Materials Physics (Poster) / 483**Effect of Banana fibers species : Banana (Musa (ABB), Musa balbisiana Colla, and Musa (AAA)) on Physical and Mechanical Properties of Epoxy Resin composites****Author:** Pongsathorn Kongkaew¹**Co-author:** Sawanya Namsak²¹ *Program of Physics, Faculty of Science and Technology, Rajabhat Maha Sarakham University.*² *Department of Science, Nongphokwittayalai School, Nong Phok, Roi-Et 45210, Thailand***Corresponding Author:** tew_sawanya@hotmail.com

The aim of this work is to study the effect of banana fibers three species : Musa (ABB)(Kluai Nammwan: A1), Musa balbisiana Colla (Kluai Tanee: A2) and Musa (AAA) (Kluai Hom thong: A3) on physical and mechanical properties of banana fiber reinforced epoxy resin composites. The finding of experiment showed that addition of B1 and B2 improves tensile strength and impact strength respectively, while fiber all species decreases flexural strength, which were lower than epoxy resin. The highest density (1.18 g/cm³) was obtained from composites of B2. For water absorption showed higher water resistance of the composites. The study confirms that the physical and mechanical properties of the composites are varies with species of the banana fibers.

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Mechanical and Physical properties of epoxy resin based hybrid composites reinforced with banana fiber three species

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This research aimed to study mechanical and physical properties of epoxy resin based hybrid composites reinforced with banana fiber three species; *Musa X paradisiaca* L. (Kluai TEEP: B1) *Musa sapientum* (Kluai Hin: B2) and *Musa sapientum* Linn. (Kluai Leb Mu Nang: B3). The mechanical properties of composites were evaluated tensile strength tensile modulus flexural strength flexural modulus and Impact strength. When Physical properties were assessed density and moisture absorption.

The findings of the study showed that the composites reinforced with B2 showed the most values of flexural strength flexural modulus and impact strength had their maximum values of 1.95 MPa 22.00 MPa and 1.42 kJ/m² respectively while moisture absorption the lowest value of 1.32 % because internal bond adhesion between fiber and matrix was well-formed Moreover, there was decrease of a void between the fiber and matrix, which increase the mechanical properties of the composite. For the tensile strength tensile modulus and density had the highest value of 16.41 MPa 354.33 MPa and 3.37 kg/m³ were of the composites reinforced with B1. Statistical analysis using One-way ANOVA has showed that there were significant of results obtained from tensile modulus impact strength and moisture absorption ($p < .05$).

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Acetylene Sensor Based on p-type Na-doped WO_3 Nanorods

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In this work, Na-doped WO_3 nanorods were successfully synthesized by a precipitation method and significantly evaluated for gas-sensing detection. The as-prepared nanoparticles and their fabricated sensing films were structurally characterized by X-ray analysis, nitrogen adsorption, and electron microscopy. The results confirmed that the p-type Na-doped WO_3 nanorods were highly crystalline with a monoclinic phase of WO_3 . The sensing films were prepared by spin coating technique and their gas-sensing performances were studied toward various gas concentrations at the working temperatures ranging from 200-350°C in dry air. It was found that the gas-sensing properties of the WO_3 sensing film selectively exhibited the highest response of ~250 to 3 vol% acetylene at the working temperature of 250°C. Moreover, the optimal sensor displayed high acetylene selectivity against C_2H_5OH , C_3H_6O , H_2 , CH_4 , NO_2 , HCHO and CH_3OH . Therefore, the p-type Na-doped WO_3 sensor is highly potential for sensitive and selective acetylene detection and may be useful for general industrial applications.

Keywords : p-type Na/ WO_3 , Nanorods, Precipitation, Acetylene, Sensor.

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Comparative Investigation on Physical and Mechanical Properties of Water hyacinth and Cattail fiber Reinforced epoxy Hybrid Composites

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In this research, the study to investigate and compare the physical and mechanical properties of water hyacinth and cattail fiber reinforced epoxy hybrid composites.

The composites were fabricated by hand lay-up process. The effect of investigation was analyzed via density, moisture absorption, microstructure, tensile strength, flexural strength and impact strength tests for total fiber contents, 15 wt% and different water hyacinth-cattail fiber ratios (10:0, 8:2, 6:4, 4:6, 2:8 and 0:10).

The results showed that the addition of water hyacinth and cattail fiber in epoxy, improves density, tensile strength, flexural strength and impact strength, but decrease moisture absorption. The analysis of the microstructure found that surface fracture behavior and void between the fiber and matrix of the composites using scanning electron microscope.

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Synthesis and characterization of Graphene Nanoribbons Prepared by one-step electrolytic exfoliation

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Graphene nanoribbon (GNR), a narrow stripe of graphene layer, has recently gained much attention due to its special electronic band gap and very large surface to volume ratio properties promising for numerous applications such as graphene-based electronic devices, energy storage and electromechanical sensors. GNR can be fabricated by several methods including unzipping of carbon nanotubes, chemical synthesis through sonication of expandable graphite, chemical vapor deposition on template and hydrothermal synthesis using ferrocene. In this work, we report a new method for one-step synthesis of GNR based on electrolytic exfoliation process. In this process, a constant potential of 8 V was applied between two graphite rods immersed in PEDOT:PSS electrolyte containing 0.05 M HNO₃ for 24 hours and the supernatant portion of the dispersion was centrifuged at 1200 rpm to remove large agglomerates. From scanning/transmission electron microscopic characterization, the dispersed products in PEDOT:PSS solution with HNO₃ addition have uniform nanostripe structures having width and length in the ranges of 5-15 and 200-300 nm, respectively while those prepared in pure PEDOT:PSS solution have typical graphene flake structures with random shape and size distribution. The number of graphene layers of GNRs was found to be in the range of 5-10 by high resolution TEM. Raman spectra of the products confirm graphene structure with distinct G and 2D peaks at 1574 and 2660 cm⁻¹, respectively. In addition, Fourier transform infrared spectroscopy demonstrate polymer free-graphene after graphene extraction from the solution. Therefore, the new organic solution-based method is attractive for GNR fabrication due to its high reproducibility, simplicity, low cost, low temperature processing and ease of large-scale production.

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Self-assembly of Iron Platinum Based Nanoparticles on Liquid and Solid Substrates

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Self-assembly of magnetic nanoparticles into a long-range monolayer pattern is under investigation in both theoretical aspect and data storage application. In this work, the effect of solid and liquid substrates on the nanoparticle assembly was compared. Iron (III) dibenzoylmethane (Fe(dbm)₃) was used as an alternative reagent to highly toxic iron pentacarbonyl (Fe(CO)₅) in the co-reduction with platinum acetylacetonate (Pt(acac)₂). The as-synthesized iron-platinum (FePt) based nanoparticles were dropped either on diethylene glycol (DEG) or directly on Transmission Electron Microscopy (TEM) grid. In the case of DEG, the drastic movement of nanoparticles during the liquid-air interface assembly tracked by a camera terminated after 15 seconds. A subsequent inspection after transferring the monolayers from DEG to TEM grid substrates confirmed the extended area of ordered nanoparticles from the liquid-air interface assembly.

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Microwave Synthesis and characterization of silver phosphate and its visible-light photocatalytic activities

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Water pollution is a major problem that impact to the world environments. There are many methods to solve this problem such as physical, biological and chemical method. In chemistry, the researcher focuses to use the new photocatalyst to treat the water pollution. One of them, silver phosphate (Ag₃PO₄) has been attention because it has high photocatalytic activities. In this research Ag₃PO₄ was synthesized by microwave irradiation method. They study the effected of pH value. Then, the products were characterized by X-Ray diffraction (XRD), Fourier Transform Infrared (FT-IR) spectroscopy, and scanning electron microscopy (SEM). The results show the products are pure Ag₃PO₄, not detect the impurity. The morphologies of the product are particles in the range size about 0.32-1.44 micrometers. Then, the photocatalytic property of as-synthesized Ag₃PO₄ was tested by the degradation of methylene blue dye in water and investigated by UV-visible spectrophotometer. The results show Ag₃PO₄ which synthesized by microwave irradiation with pH 4 at 180 W for 3 h is the highest degradation MB efficiency about 99.56 percent for 100 min.

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Design and development of magnetic refrigeration prototype for the performance analysis of magnetocaloric materials

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Magnetic refrigeration (MR) has been receiving an attention as an alternative system to conventional refrigeration based on vapor compression. Normally, the vapor compression uses hydrofluorocarbons (HFC) and Chlorofluorocarbons (CFC) as refrigerant fluids which damage ozone layers causing global warming. Consequently, the magnetic system has been developed to replace the traditional system to reduce global warming potential (GWP). The alternative cooling technology is based on the magnetocaloric effect (MCE) of magnetocaloric materials (MCM) which are able to change their temperature following magnetic flux density under magnetic field generator. The refrigeration is operated via an active magnetic regeneration (AMR) cycle with rotating magnets. In this work, the magnet assembly has been designed and studied with the aspiration for compact and efficiency. Based on extensive reviews, the magnet assembly model of Okamura *et al.*¹ provides the conceptual design with optimal compactness and efficiency. Hence, in this study, the magnet assembly design has been developed based on the model by Okamura *et al.* The magnetic system consists of a soft magnetic composite stator and four neodymium (NdFeB) permanent magnets rotated by motor. The magnetic field performance of the assembly is analyzed using the COMSOL Multiphysics software. The generated magnetic field is 0.65 T provided by only 0.9 L of permanent magnets. In addition, the efficiency of the magnet design is represented by a figure of merit parameter, Λ_{cool} . Among others, the proposed design exhibit a high Λ_{cool} value of 0.17, which is as high as five times better than the magnet assembly designs by prior work.

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Microstructure, Hardness and Corrosion Resistance in Destabilised 28 wt.%Cr-1 wt.%Mo Cast Iron

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High chromium cast irons are widely used as abrasion resistant wear parts in mining, mineral and cement industries. Their abrasion and corrosion resistance can be improved by destabilisation heat treatment and element addition. Mo additions to high Cr irons lead to the formation of M₂C or M₆C type carbides depending on the Cr/C ratio. In the present work, iron containing 28 wt.%Cr-3 wt.%C-1 wt.%Mo was investigated. The as-cast specimen was destabilised at 1000 °C for 4 h and then hardened by air cooling to room temperature. Microstructures were investigated by light microscopy, scanning electron microscopy and transmission electron microscopy. Phase identification was performed by X-ray diffraction and selected-area electron diffraction. Vickers macro-hardness testing was performed using 30 kgf load and 15 seconds indenting time. A potentiodynamic technique was used to determine aqueous corrosion resistance via analysis of the anodic polarisation characteristics in a solution of 0.5 molar sulphuric acid. The results revealed that the as-cast microstructure of the 28 wt.%Cr-3 wt.%C-1wt.%Mo iron consisted of austenite dendrites and multiple eutectic carbides including M₇C₃, M₂₃C₆ and fish-bone M₆C were found. Carbide transitions as M₇C₃→M₂₃C₆→M₆C were also observed. After destabilisation, secondary carbides were precipitated within the prior austenite matrix, which later transformed to martensite during air cooling. Selected area diffraction pattern confirmed that secondary carbides are M₂₃C₆. Furthermore, microstructural change was observed as eutectic M₇C₃ transformed to M₂₃C₆ after destabilisation heat treatment. Destabilisation heat treatment increased the Vickers macro-hardness from 520 HV₃₀ in the as-cast iron up to 780 HV₃₀ due to precipitation of secondary carbides which destabilised the original austenite leading to a martensite matrix on air cooling. The as-cast iron had lower values of critical current density and passive current density compared with the destabilised iron. In the as-cast iron, more severe localised attack was found only in the eutectic matrix (austenite + martensite) adjacent to the eutectic carbides. In the destabilised iron, both dendritic and eutectic matrix regions were attacked. The dendritic matrix regions were attacked due to the presence of secondary carbides.

A013: Materials Physics (Poster) / 580**Fabrication and Characterization of Graphene-based Heterostructure and Basic Characterization of CVD Graphene****Authors:** Siripong Patwong^{None} ; Thiti Taychatanapat¹¹ *Department of Physics, Faculty of Science, Chulalongkorn University***Corresponding Author:** siripongpatwong@gmail.com

In this project, we focus on fabrication and characterization of graphene-based heterostructures. First, we use "Pick-up method" at low transfer temperature ($T = 40 - 60$ oC) in order to fabricate the h-BN/graphene/h-BN van der Waals heterostructure on silicon oxide substrate. We find that transferring graphene at low temperature leaves hydrocarbon residues between graphene/h-BN interface which show up as bubbles. To avoid these bubbles, we use high transfer temperature ($T = 110$ oC). We find that, with high transfer temperature, h-BN/graphene/h-BN van der Waals heterostructures are atomically flat with no bubbles at the interfaces when observed by an optical microscope. To confirm this observation, we use atomic force microscope to study surface morphology of our heterostructures and find no bubble present in our samples. In addition, graphene has no structural damage during high-temperature transfer process as evidenced by the absence of D peak in Raman spectra.

Furthermore, we transfer CVD graphene to silicon oxide substrate by wet transfer method. We observe that graphene thickness is not uniform. Some area has a few layer graphene while other areas have no graphene at all. In addition, we observe copper ion residues from copper foil which does not get completely etched away during the wet transfer process. We find that the resistance of CVD graphene is about $40 \text{ k}\Omega$ and $2 \text{ k}\Omega$ when measured by 2-probe and 4-probe measurements respectively. Hence, the high resistance of CVD graphene when measured by 2 probe measurement is a result of high contact resistance which is approximately $38 \text{ k}\Omega$.

A013: Materials Physics (Poster) / 585**Glucose Sensing Characterization of Non-Enzymatic Nickel plate and Nickel Foam Electrodes in Sodium Hydroxide Solutions****Author:** Parit Tekacharin^{None}**Co-authors:** Viriyah Chobaomsup ; Aththadej Kamchaddaskorn ; Oratai Jongprateep ; Maythee Saisriyoot ; Krissada Surawathanawises ; Yuttanant Boonyongmaneerat ; Ratchatee Techapiesancharoenkij**Corresponding Author:** parit.tek@ku.th

Sugar is one of the most common ingredients in most of the food processing. Recently, the social healthy trend raises awareness on the sugar control in foods, leading to a demand on a fast and simple sugar sensor. Recently, a non-enzymatic glucose sensor has gained a lot attention, because it is re-useable, fast and simple, as opposed to traditional enzymatic glucose sensor. In this work, two types of electrodes, including Electroplated Ni film and Ni foam, were used as sensing electrodes for a non-enzymatic glucose sensor. The Ni film and Ni foam sensing electrodes were investigated for their quantitative and qualitative sensing properties for glucose. The studied sensing properties of the Ni film and Ni foam included sensing sensitivity, selectivity, and detection limit. For the sensitivity and selectivity analysis, the sensing electrodes, with geometrical working area of 1 and 2 cm^2 for Ni foam and Ni film respectively, were submerged in a 1M NaOH solution, connected as a working electrode. Ag/AgCl and Pt were used as a reference and counter electrodes, respectively. Amperometric scanning measurement was used for the sensitivity and selectivity analysis. Sensitivity measurement was tested by dropping glucose solutions into 1M NaOH solution and recording the amperometric response of the sensor under varying sugar contents.

The results showed that Ni foam electrode exhibits higher sensitivity, which average sensitivities are 1.1048 and $6.4228 \text{ mAmm}^{-1}\text{cm}^{-2}$ for Ni plate and Ni foam respectively. Limit of detection (LOD) was calculated by the equation $\text{LOD} = 3S_a/b$ (S_a is standard deviation of current density

when glucose concentration equal to 0; b is sensitivity of electrodes). LOD of Ni film and Ni foam are 0.0143 and 0.0144 mM, respectively. The selectivity of electrodes were tested by dropping 3 types of disturbing agents: Quinine, Acetic acid and NaCl. The disturbing agents showed no effect on the current density signal during the amperometric measurement for both of the Ni plate and Ni foam electrodes.

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The effect of silane type on mechanical properties and fogging phenomenon of lamp socket rubber

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Bis-(3-triethoxysilylpropyl) tetrasulphide (TESPT) and 3-mercaptopropyltrimethoxysilane (MTMO) are used as silane coupling agent for silica fume. The modified silica fume is used as reinforcing filler in ethylene propylene diene monomer (EPDM) for lamp socket rubber. The cure characteristics, rubber mechanical properties and fogging phenomenon of lamp socket rubber are investigated. Test results show that the maximum torque (M_H) and differential torque ($M_H - M_L$) increase but the minimum torque (M_L) and cure time at 10% and 90% decrease with the increasing of silane coupling agent loading. The comparison rubber mechanical properties of modified silica fume by TESPT and MTMO are also discussed. The TESPT shows the enhancement in rubber mechanical properties such as hardness, tensile strength and 300% modulus more than MTMO. For the fogging test of lamp socket rubber by gravimetric method which is used for control rubber products quality in automotive industry. The using of modified silica fume by TESPT show the better result than MTMO due to less mass of condensable constituent.

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Property of BCT-NBT ceramics preparation by mixed oxide method

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In this research, the $(\text{Ba}_{0.90}\text{Ca}_{0.10})_{0.90}(\text{Na}_{0.5}\text{Bi}_{0.5})_{0.10}\text{TiO}_3$ or BCT-NBT ceramics prepared by mixed oxide method with various sintering temperatures were investigated. The optimum calcination condition was found at 850°C for 4 h. These powders were pressed and sintered at 1000-1400°C for 3 h with a heating rate of 50°C/min. The microstructure was examined by scanning electron microscope (SEM). Density of the sintered samples was measured by Archimedes method with distilled water as the fluid medium. Dielectric properties at room temperature were examined by LCR meter. The results showed that, the average grain sizes were increased with increasing sintering temperatures, The sintering temperature at which the density, dielectric properties are optimum is 1300°C. The density was about 5.4 g/cm³, the dielectric constant at room temperature was 513 and dielectric loss was 0.03 at 1 kHz frequency.

Keywords: BCT-NBT ceramics, mixed oxide method, dielectric properties

A013: Materials Physics (Poster) / 623

Miscibility of PS-PI diblock copolymer by Molecular Dynamic and Mesoscopic Simulations

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Molecular dynamic and mesoscopic simulations are used to predict the morphologies of PS-b-PI diblock copolymer. Flory-Huggins interaction parameter is an intermediate parameter used to connect between both simulations. The repulsions between different beads are one of essential parameters that were calculated from the Flory-Huggins interaction parameter. The calculated repulsion is 3.79 kJ/mol. Topology parameter was calculated from polymer chain length concerning its characteristic properties. S 4 I 5 is a mesoscopic topology that was used to represent polymeric chain consisting of 50 and 44 of degree of polymerization for polyisoprene and polystyrene, respectively. The morphology at equilibrium was confirmed by free energy density and order parameters from mesoscopic simulation. The stability of obtained morphologies from the obtained pattern was confirmed. In this study, the diblock copolymers are miscible and disordered phase was obtained.

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Optical Properties of CsI:Tl Crystals Grown Using Different Precursors Purities

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CsI doped with Tl (CsI:Tl) is a scintillator material used for radiation detector applications. CsI:Tl was crystallized by a modified homemade Bridgman-Stockbarger technique using different precursor purities. The purpose is to verify effects of precursor purity on optical properties of Cs:Tl crystals by UV-VIS and X-ray luminescence spectroscopy. A concentration of impurities in the precursor is directly related the optical properties of CsI:Tl crystals. The CsI:Tl crystals were grown in two levels of CsI and TlI reactant materials, i.e., having as a very high purity of 99.999 %, showing a colorless crystal and a high purity of 99.9 % showing an orange crystal. Absorption coefficient determined by transmittance and reflectance spectra was used to find an optical gap in the CsI:Tl crystals. For colorless crystal, optical gap of the Tl-related state and the CsI bandgap, which were located at 3.5-3.8 eV and 5.0-5.2 eV, respectively, was observed. On the other hand, a merging of Tl-related state and CsI bandgap was observed for the orange crystal. Also, X-ray luminescence spectra centered at around 2.0 to 2.5 eV showed a red shift for the orange crystal. These results indicated effects of precursor purity on optical gap of the CsI: Tl crystal.

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Effects of Substrate Temperatures during Spray Processing on Colored Perovskite Properties

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Mixed halide perovskites MAPb(I+Br)₃ (MA=CH₃NH₃) are strong candidates for thin-film solar cells, as they are solution processable with excellent photovoltaic properties. With both halide and dimensionality tuning, colored perovskites can be fabricated with potential application for semi-transparent solar cells. Typically, spin coating is utilized for perovskite formation. However, to enable future large scale production, we explored spray processing for these semi-transparent materials. For spray fabrication, substrates are generally heated while coating for better film quality. This work studied morphological, optical, and electronic effects of substrate temperatures for three distinct colored mixed halide perovskites. The optimal temperature close to 200°C caused larger grains, higher absorption, better crystallinity, and good charge separation, yielding positive signs for superior photovoltaic performance.

A013: Materials Physics (Poster) / 657

Study of morphology and optical properties of cellulose and carbon nanotube composites

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Cellulose has attracted much attention from researchers because of its unique properties. Whereas cellulose is a non-conductive, carbon nanotube (CNT) shows higher conductivity and thermal conductivity. CNT/cellulose composite fibers are prepared with 2 conditions: CNT concentration and mixing temperature. CNT/cellulose composite has been characterized by Ultraviolet-visible spectrophotometer (UV-Vis), Optical microscope (OM), Fourier-transform infrared spectroscopy (FTIR), Scanning Electron Microscope (SEM) and tensile. The results show that the high concentration of CNT, the less transmittance. Moreover, the CNT/cellulose composite at high temperature shows a higher transmittance than that at room temperature for high CNT concentration.

A013: Materials Physics (Poster) / 670

A numerical model of multi-layered regenerator for a prototyped magnetic refrigerator

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Magnetic refrigerators have emerged as an important trend in the refrigeration industry. They are believed to be more efficient than current and popular cooling systems by approximately 50%. The underlying principles of magnetic refrigerators are the thermodynamics laws of changing in temperature associated with magnetization and demagnetization of a magnetic regenerator. A numerical model of heat exchange between the magnetic materials and fluid is capable of explaining the temperature span, coefficient of performance (COP), for example. It can also clarify the influences of various variables effecting to magnetic refrigerator, such as mass flow rates, magnetic solid geometries, and arrangements of the magnetic materials. A numerical model has been developed to study a multi-layered and parallel plated active magnetic regenerator (AMR), where each layer has different Curie temperatures. The model is aimed at calculating temperature spans and COPs in order for the further optimization of layer lengths and types of layers. The implicit Euler method of finite difference is used in solving relevant coupled heat equations subjected to reasonable initial and boundary conditions. The results are then compared with data derived from common refrigerator systems.

A013: Materials Physics (Poster) / 677

Electrical properties and microstructure of phase combination in BaTiO₃-based Ceramics

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Perovskite barium titanate (BaTiO₃) ceramics are widely used in electronics industries such as capacitors, sensors and actuators. BaTiO₃-based ceramics have good dielectric, ferroelectric and piezoelectric properties. BaTiO₃ powder was fabricated by mixed-oxide method via a vibro-milling technique. The pellets were then placed in a high purity alumina crucible in air and sintered at 1375 °C for 1, 2, 4 and 8h. X-ray diffraction technique was used to investigate phase formation of BaTiO₃ ceramics. Grain size was measured by scanning electron microscopy (SEM). The computer-controlled dielectric measurement system consisted of a high precision LCR-meter. Electric field induced polarization was measured by Sawyer-Tower circuit. In this work, the effect of phase combination in BaTiO₃-ceramics on electrical properties (dielectric and electric field induced polarization) and microstructure was investigated.

A013: Materials Physics (Poster) / 694

Effects of Yttrium Doping on Acetone Sensing Properties of Flame-spray-made SnO₂ Nanoparticles

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Abstract. In the present study, gas-sensing properties of flame-spray-made 0-2 wt% Y₂O₃-doped SnO₂ nanoparticles are systematically and selectively studied for detection of acetone (C₃H₆O) which practically occurred in specific applications. Structural characterizations by electron microscopy, X-ray analysis and nitrogen adsorption further confirmed the formation of loosely agglomerated SnO₂ nanoparticles (5-15 nm) with high specific surface area and highly crystalline tetragonal-cassiterite SnO₂ structure doped with Y³⁺ oxidation states. The gas-sensing properties of undoped SnO₂ and Y₂O₃-doped SnO₂ sensors were systematically tested towards C₃H₆O under atmospheric conditions at the working temperature ranging from 200-350°C. Tested results indicated that the optimal 0.2 wt% Y₂O₃-doped SnO₂ exhibited high responses of ~322 to 400 ppm acetone under exposure at working temperature of 350°C in dry air compared with undoped one. Moreover, the optimal Y₂O₃-doped SnO₂ sensors evidently displayed high selectivity against various gas/vapor categories including flammable gases, toxic gas and VOCs. Therefore, Y₂O₃-doped SnO₂ sensors are potential for responsive detections of C₃H₆O at ppm-level but with limited selectivity and may be useful for environmental and biomedical applications.

Keywords : n-type Y/SnO₂, Nanoparticles, Acetone, Acetylene, Sensor.

A013: Materials Physics (Poster) / 705

Pearlitic ductile iron-like sintered Fe-Cr-Mo-Si-C alloys

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Sintered Fe-Cr-Mo-Si-C alloys, produced from two different pre-alloyed powders with compositions of Fe-3.0Cr-0.5Mo and Fe-1.5Cr-0.2Mo, showed a microstructure similar to that of a fully pearlitic ductile cast iron (DCI EN GJS700-2). The two sintered alloys exhibited close values of area fractions of a black particle (7 % of area fraction for the sintered Fe-1.5Cr-0.2Mo-inherited alloy or sintered 1.5Cr alloy and 6 % for the sintered Fe-3.0Cr-0.5Mo-inherited alloy or sintered 3.0Cr alloy) and a pearlitic matrix (93 % for the sintered 1.5Cr alloy and 94 % for the sintered 3.0Cr alloy). The absence of a ferrite shell surrounding a black particle in these alloys was influenced by the alloying chromium. Despite similar microstructural feature, the two sintered alloys showed different tensile properties. With higher alloying element content, the sintered 3.0Cr alloy showed inferior tensile strength and elongation. The reason for lower tensile strength of the sintered 3.0Cr alloy could not be given by microstructural feature differentiation. Further investigation has been being carried out.

A013: Materials Physics (Poster) / 708**Characteristics of mesoporous silica nanoparticles synthesized by a simple method****Author:** Thanapog Noipanya¹**Co-author:** Chalad Yuenyao²¹ 0979433893² _**Corresponding Authors:** pond1997love@gmail.com, chalady_2012@hotmail.com**Abstract**

This research synthesized the mesoporous silica nanoparticles. TEOS is used as a precursor and two types of surfactant, CTAB and TTAB, to be used as structure directing agent. To compare the effect of template type on the characteristics of synthetic particles, molar ratio of precursor to template is equally controlled. The co-condensation combine with bi-phasic techniques are utilized for this synthesis. The as-synthesized particles were incinerated to remove the directing agent at about 500-800 °C under atmospheric pressure. To confirm the quality of synthesized nano-silica, characteristics of nanoparticles are characterized by several analytical techniques. Morphology, particle size and composition are analyzed by SEM and TEM, while affinity to water is analyzed by measuring the water contact angle at different position on the surface of the obtained particles. Surface area and pore volume are determined by BET technique, while crystallinity and functional groups present in the nanoparticles were analyzed by XRD and FTIR techniques, respectively. Preliminary results showed that the whiteness of silica powder increase as the incinerate temperature is increased. The synthesized silica is approximately 25-35 wt% of the initial weight of substrate. Comparison of the surface area (SA) of calcined and non-calcined particles showed that calcined silica have higher SA than non-calcine silica. As can be seen from SEM and TEM results, the synthesized particles are mesoporous silica nanoparticles. This study confirmed the synthesis of porous silica nanoparticles by a simple method.

Keywords: Characteristics; Mesoporous; SiO₂; Nanoparticles; Synthesis.

A013: Materials Physics (Poster) / 733**Effect of Potassium Hydroxide (KOH) Activation to Porous Carbon Electrode Synthesized from Bamboo Shoots as the of Supercapacitor Electrode****Author:** Tanachai Ponken¹**Co-authors:** Phatcharin Phumuen²; Narongsak phosopa; Suparuk Glomjai; Patin Tagsin; Authit Phakkhawan; Pawinee Klangtakai¹ Program of Physics, Faculty of Science and Technology, Rajabhat Mahasarakham University² 0968277345**Corresponding Authors:** tanachaiponken@gmail.com, noon.phat21443@gmail.com,

Carbon powder was prepared from bamboo shoots by chemical activation. The porous carbon powders were activated by potassium hydroxide (KOH) at 400, 500 and 600°C for 2 hrs under argon (Ar) atmosphere with carbon powder (C): KOH ratio of 1:1, 1:2, 1:3 and 1:4 by weight, respectively. The crystal structure, morphological properties and the porosity of carbonaceous powders were investigated by x-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDX), scanning electron microscope (SEM) and the nitrogen adsorption techniques using Brunauer Emmett Teller (BET). The electrochemical properties of supercapacitor electrode was measured by the charge/discharge (C.D.) measurement and the cyclic voltammetry (CV). The specific capacitance of non-activated carbon has

the lowest value of 6.5 F/g owing to its lowest specific surface area (1.324 m² g⁻¹). The specific surface areas of activated carbon were increased to 1,017, 1,162, 1,257 and 1,012 m² g⁻¹ for the C: KOH ratio of 1:1, 1:2, 1:3 and 1:4 by weight, respectively. The specific capacitances of activated carbon electrode were increased to 11.3, 26.6, 50.5 and 40.5 F/g for the C: KOH ratio of 1:1, 1:2, 1:3 and 1:4 by weight, respectively. The C: KOH ratio of 1:3 at 600 °C give the highest specific capacitance value of 50.5 F/g owing to its largest specific surface area (1,257 m² g⁻¹) showing the good candidate for fabricating commercial supercapacitors.

A014: Environment (Poster) / 817

Study on corn silk drying for corn silk tea

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The objectives of this research were to study silk corn drying using microwave oven technique and to find out the appropriate thin layer equation for predicting the drying kinetic of silk corn. To achieve these purposes, experiments were conducted on drying electric power of microwave oven 300, 500 and 700 W. The effects of drying conditions on moisture ratio, drying rate, humidity absorption and some properties when make tea. From experimental results, it was revealed that increment of drying time each electric power. Furthermore, it was found that thin layer equation providing the highest coefficient of determination (R²) and the lowest root mean square error (RMSE).

A014: Environment (Poster) / 606

Levels of Indoor Radon Concentration in Schools: Case Study in Schools in the Northeast Thailand

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Radon is a human carcinogen and a serious public health problem. High radon inhalation for long periods can increase the risk of lung cancer. There are many studies in Thailand focused on the radon hazard posed in the home. However, no report of its level in school for children is observed. Children have been reported to have greater the risk than adults for certain types of cancer from radiation and children spend much of their time at school next on down their home. In this study, the indoor radon concentrations obtained from 9 schools in the Northeastern of Thailand were measured by solid state nuclear track detectors (SSNDTs) using CR-39 detectors in closed cups, by a short-term test (90 days). Radon cups were placed in the different ground floor of kindergarten classrooms for 8 cups per room. The indoor radon concentrations (Bq/m³), annual effect dose (mSv/y), total annual effect dose (mSv/y) were calculated from the measured track densities using the radon calibration

factor. The calibration factor was carried out using CR-39 detectors in closed cups at Radon laboratory at Thailand Institute of Nuclear Technology (TINT). The results showed that the indoor radon concentrations were in the range of 13 to 89 Bq/m³ with an average value of 29.44 Bq/m³, the standard deviation was 7.25, the maximum and minimum indoor radon concentration values were found in Bantadnoontonglang and Buchaokun school, respectively. The measured indoor radon levels did not exceed the US Environmental Protection Agency (US EPA) safety limit of (148 Bq/m³). The annual effective dose was in the range of 0.08-0.53 mSv/y with an average value of 0.18 mSv/y and the standard deviation of 0.14. The total annual effective dose ranged from 0.55-1.01 mSv/y was found which was a little bit exceeding the annual dose limit (1 mSv/y) for the general public regulated by International Commission on Radiological Protection (ICRP). The radon concentration and the annual effective dose values were also compared with those obtained in the other countries. These data were taken as part of radon mapping in Thailand.

A014: Environment (Poster) / 435

THE EFFECT OF GRANULAR MATERIAL ON STRESS STATE TRANSDUCER

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Soil compaction is one of the serious problems in crop production. It has occurred under stress in the soil, which induced by agricultural machines. Therefore, it is necessary to characterize stress in the soil so as to predict soil compaction. The stress state transducer is a device to derive the stresses in the soil. The purpose of this laboratory work is to study the effect of granular material as a medium on statically stress that occurs on each plane of the stress state transducer ($\sigma_x, \sigma_y, \sigma_z, \sigma_{n1}, \sigma_{n2}$ and σ_{n3}). In the experimental test, the stress state transducer was placed inside dry sand with different granular sizes, then vertical pressure loading and unloading processes were applied to a range of 0 – 200 kPa. The z-direction stress was compared with the reference pressure and the results found that grade I sand gave the quiet linear relationship between applied load as this equation $\sigma_z = 0.747P_{ref} + 16.5249$, $R^2 = 0.9866$ and corresponding stress on loading process. In unloaded case, the pressure was higher than load testing and the hysteresis of 15.7305 %. Including to the relationship of stresses on other planes were similar too. A similar tendency was observed in the larger granular size of sand, but with less linearity.

A014: Environment (Poster) / 678

Sources and trajectories of particulate matter measured at Lampang Rajabhat University

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High levels of the fine particulate matter in the air is one of the reasons that affect the respiratory and health problems to human and animals. This research aims to study and analyze the source locations of the fine Particulate Matter (PM), particularly PM1, PM2.5 and PM10 measured at the Lampang Rajabhat University (LPRU) using the optical particle counter scattering technique during February 2017 to February 2018. The amount of anthropogenic and biogenic PM emissions were determined by subtracting the surface PM concentrations from the effect of meteorology using Multiple Linear Regression (MLR). Trajectory of the PM sources were then analyzed using the Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) software in both forward and backward analysis at a

level of 1,000 meters AGL. The seven-day and every six hour data were classified and clustered using a statistical method to group the air flow trajectories. The results from MLR showed that all PM types were high during the dry season with three peaks of high PM levels, i.e. 1) Feb 23 – Mar 23, 2017; 2) Apr 4 – 12, 2017; and 3) May 15 – 24, 2017. In these periods, the results from HYSPLIT showed that the trajectories came from the northwest, southwest and west directions, respectively, where the hotspots were found from MODIS information.

Keywords : Particulate matter, Meteorological factors, Hot spot, HYSPLIT

A014: Environment (Poster) / 600

Study and Analysis of Particulate Matter Sources in Lampang

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This research aims to study and analyze the sources of particulate matter (PM) in Lampang which is measured by the Pollution Control Department (PCD) at 4 stations: 1) Department of Meteorology Phrabat, 2) Health Promotion Hospital Ban Soppad, 3) Bandong District Administrative Organization and 4) Mae Moh Provincial Waterworks Authority. Unusual periods of high PM were analyzed using multiple linear regression and then modelled the air mass trajectories in both backward and forward analysis using the Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) trajectory model. Trajectories were produced every 6 hours for 7 days during the peak of PM levels. The results showed that PM in Lampang was high during February - April. The source of PM in the district of Phrabat, Soppad and Mae Moh stations were transported from the northwest and the southwest. The source of PM in BanDong district was from the southwest and southeast. All trajectories passed through where the hotspots (data from MODIS C6 active fire product) was located. We also noted that the source of PM in Lampang is caused from the forest fire or open burning in the local area as well.

Keywords : particulate matter, Multiple Linear Regression, HYSPLIT, MODIS C6

A014: Environment (Poster) / 703

Development of Germinated Parboiled Thunya-sirin Glutinous Rice Product under Modified Greenhouse Dryer

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The objective of this study was to development of germinated parboiled Thunya-sirin glutinous rice product under modified greenhouse dryer. The research was to determine on compared of physical properties of rice such as (color values (L, a, b), cooking index, texture, sensory evaluation and chemical analysis in the free radical scavenging activity of the germinated parboiled Thunya-sirin glutinous rice was examined in vitro using DPPH radical. Experimental conditions Thunya-sirin glutinous rice was covered with water, placed in a preferably warm place, and soaked for between 48 and 72 hours. The drying experiments were carried using a greenhouse solar drying temperatures range from 50-60 degrees Celsius.

Drying process duration of the increment in the air relative humidity led to a slight increase in the drying time indicates that any increment in air temperature caused a decrement in drying time. The germinated parboiled Thunya-sirin glutinous rice soaked at 72 hours dried under hot air drying have a best cooking index, after the drying process, the brightness (L) decreases while the red value (a) is yellow (b). The

texture of processed rice has improved qualities. The sensory evaluation revealed that 48 hours of germinated rice has the highest acceptance score. The antioxidant activity of rice after drying was decreased and duration of germination period effects on antioxidant activity.

A014: Environment (Poster) / 719

The studying of Soil Gas Radon Probe coupled with RAD7 to identify Active Faults

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A soil gas radon probe with a radon detector (RAD7) were studied and developed for investigating radon irregularity to determine the location of active faults which can result in earthquakes. The 2 types of gas probe (A and B) were designed with the diameter of 1, 2, 1.7, 2.5, and 4.5 cm and the length of 50, 100, and 150 cm to embed into the soil. These probe were taken to test with the 27 sets of operation parameters of RAD7 to determine the appropriate operation mode. The results showed that the probe A which has a diameter of 1 cm and a length of 100 cm with the RAD7 operation parameters of “Mode: Auto, Pump: Auto, Tone: Chime” had the highest radon sensitivity with the radon concentration of $15,693.75 \pm 125.275$ Bq/m³. Then, the probe B which has a diameter of 1.0 cm and a length of 150 cm with the RAD7 operation parameters of “Mode: Normal, Pump: Grab, Tone: Off” was the second best radon sensitivity with the radon concentration of $14,251.56 \pm 119.38$ Bq/m³. These results indicated that the developed gas probe can be used to investigate the radon irregularity to determine the location of active faults which can result in earthquakes.

A014: Environment (Poster) / 746

A pilot study stable isotope ratio and elemental compositions in Bird's Claw Rice (Khao Leb Nok) in the south of Thailand

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In recent years, local Thai rice has been sharp-rising demands for consumers with high purchasing power who are willing to pay for nutritious grains and specialty rice. Khao Leb Nok (Bird's Claw Rice) is traditional southern variety with high nutritious and popular rice grown in the south of Thailand. This study was done to investigate the isotopic compositions ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$) and the elemental compositions (%C, %N and %O) in rice samples obtained from different provinces of cultivation. Forty-one samples of Leb Nok rice were collected from Phatthalung and Nakhon Si Thammarat provinces and their $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$, %C, %N and %O values were determined using elemental analyzer isotope ratio mass spectrometry (EA-IRMS). Our result found that $\delta^{18}\text{O}$, %O and %C in Leb Nok rice samples were significantly different but there was no evidence that $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and %N was significantly different among the provinces at 95% confidence interval. The $\delta^{18}\text{O}$, %O and %C values showed good potential in differentiating Leb Nok rice from different geographical provinces. This technique may be possible to trace the geographical origin of rice cultivated from different regions in Thailand.

A014: Environment (Poster) / 747

Stable isotope ratio of local rice samples in Thailand

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Stable isotopes including ¹³C, ¹⁵N and ¹⁸O of local Thai rice samples were carried out using elemental analyzer isotope ratio mass spectrometry (EA-IRMS). Thai rice samples, Khaowong sticky rice, Pakaumpul local rice, and Jek Chuey Sao Hai rice were cultivated from Kalasin, Surin, Saraburi provinces, respectively. In this study, we report the stable isotope ratio of rices for the isotopic characteristics of Thai rice cultivated from different provinces. The analysis of variance (ANOVA) and multiple comparisons using Least significant difference (LSD) were also investigated. Stable isotope ratio of ¹³C/¹²C and ¹⁸O/¹⁶O were good characteristic indicators for Thai jasmine rice that could be applied for the geographical origins of rice.

A014: Environment (Poster) / 764

Determination of Heat Transfer Coefficient of Organic Chiangda Tea (*Gymnema inodorum* Lour.) under Hot Air Convection Drying

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Organic chiangda tea it's contains antioxidants which help to maintain balance in the body. The purpose of this research was to study the effects of drying temperature drying on the change of moisture content of organic chiangda tea drying. Additionally, the heat transfer coefficient and effective moisture diffusivity of organic chiangda was investigated under hot air convection drying. Experimental parameters for investigation were drying air temperature of 40-60°C and drying air velocity of 0.5 m/s. The results showed that the effective moisture diffusivity of organic chiangda was rapidly increased the increase of drying temperature. The heat transfer coefficients of organic chiangda were in a range of 26-1000 W/m²°C, 59-300 W/m²°C and 29-280 W/m²°C for drying air temperature at 40, 50, and 60°C, respectively.

A014: Environment (Poster) / 766

Elemental quantification of airborne particulate matter at Nongkung tao, Thasongkhorn Sub-district, Muang district, Mahasarakham Province, by x-ray fluorescence technique

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The research as study to elemental quantity in particulate matter (PM10) at community where near factory as source found analysis of PM10. Which PM10 smaller sizes than of 10 μm from soil, rock, ash from leaf and ash from bagasse, respectively. PM10 were collected from around area and were pumped into filter paper by personal pump machines. PM10 were weighted by four point digital balance as calculate the concentration of PM10. PM10 was analyzed by x-ray fluorescence.

Results found that the elemental quantity of soil, rock, ash from leaf consists several silicon (Si) and calcium (Ca) which matching with the PM10 into filter paper by personal pump. PM10 from ash bagasse consists several Potassium (K) and sulfur (S) which non matching with the PM10 into filter paper. Moreover, the 4 day of standard exceeds concentration on 19, 29 February 2017 and on 6, 13 March 2017 which the concentration values of 0.163, 0.204, 1.1029, 0.163 mg/m^3 , respectively due to factors of vehicular traffic, burn waste and road construction. Hence, elemental quantity in PM10 at Nong kung tao, Thasongkhorn Sub-district, Muang district, Mahasarakham Province can't found from bagasse but sources of elemental was found from soil, rock and ash from leaf.

A014: Environment (Poster) / 777

Numerically Simulations the Germinated Parboiled Thunya-sirin Glutinous Rice under a Combined Far infrared Radiation and Air Convection Drying

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The objective of this study was to describes the development of a three-dimensional (3-D) mathematical model, which was used to during drying of germinated parboiled Thunya-sirin glutinous rice product under dryer. The three-dimensional mathematical models were solved numerically using the finite element method; additionally the mathematical model was validated by comparing the simulated results with the experimental. In this study, the following drying parameters were set for investigation: Far infrared intensities at 3 to 5 kW/m^2 were combined with a 40oC temperature and 1 m/s air velocity. The results showed that the mathematical model can be satisfied to predict the evolutions of germinated parboiled Thunya-sirin glutinous rice product. An increase of the applied intensity from 3 kW/m^2 to 5 kW/m^2 resulted in the shorter drying time and the reduced energy consumption by 70 min and 5.29 kWh/kg water removed, respectively. The average effective moisture diffusivities of the germinated parboiled rice were in the ranges 1.25×10^{-10} – 3.48×10^{-10} m^2/s .

A014: Environment (Poster) / 801

Applying Isotope Techniques for Identifying Groundwater Dynamic in Phrae Basin

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Phrae Basin is located in the north of Thailand by condensing manner Basin along the north to south. A total catchment area of the basin is about 18,000 km^2 . During rainy season, it has

been some problem about flooding almost every year. Moreover, drought problem has been suffered in dry season. The groundwater resources were used for supporting agriculture activities such as growing rice during dry period and local water supply. This area is located in the middle Yom river basin and very important to manage water resources for reducing the impact of both problems. Groundwater dynamic is clearly to plan groundwater used for agriculture use and domestic use as well as impact from flooding and drought areas in the lower Yom river basin. Groundwater and surface water were collected for stable isotopes and chemical analysis in dry season and wet season. Stable isotopes were analysed by Laser Water Isotope Analyzer and chemical composition analysed by Ion Chromatography. From the results, the origin of groundwater samples is from local rainfall and groundwater samples in some area showed mixing with surface water from river or reservoir. The groundwater samples from different aquifers demonstrated the interconnection between shallow and deep aquifers. The most groundwater samples in the Phrae River basin were calcium bicarbonate and sodium bicarbonate type by cationic exchange along the flow path.

A014: Environment (Poster) / 806

The analysis of correlation between the outdoor temperature and electric energy consumption of air-conditioning system based on moist air properties

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The monitoring indoor climate, outdoor temperature and electric energy consumption of an air-conditioning system was collected via the internet network and was analysed for the correlation between the outdoor temperature and electric consumption for energy management. Moist air properties were employed to setup the correlating equation that can be used to predict the energy consumption of the air-conditioning system. The simulated result compared with the real data is presented.

Keyword: outdoor temperature, enthalpy, moist air, energy consumption

A014: Environment (Poster) / 422

Study of Floater for Electricity Production from Wave Energy

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The wave energy is an alternative energy type. The energy quantity obtained from wave depended on many parameters such as the shape of floater, the wave height and the mechanism of energy transformation. Understandings in the effect of these parameters are necessary for wave energy utilization. Therefore, this research designed and constructed the floater testing set (FTS) for study the effect of floater, wave height and energy transformation method on electricity production by wave energy. The FTS size was 1.4 m x 6 m x 1.5 m for the width, the length, and the height, respectively. The FTS consisted of two main parts namely wave creation part and energy transformation part. In the wave creation part, there was a paddle which is driven by motor 2 HP for push water become a predetermined wave. The energy transformation part comprised of generator, inverter and floater. In experimental operation, the wave height was varied between 15 and 20 cm at the frequency of 38 waves per minute. The floater used three types as followed boat floater (BF), pontoon floater (PF) and

round floater (RF). The method of energy transformation used two methods namely fixed and non-fixed base of energy transformation part. The experimental results were shown regarding electrical power output (EPO) and the efficiency of generator. Results showed that the EPO and efficiency of generator significantly increased with the wave height. The fixed base of energy transformation part gave the EPO and generator efficiency higher than the non-fixed base. BF type had the maximum value of EPO in fixed base case, but it had the minimum value of EPO in non-fixed base case. The EPO maximum value in fixed base case was 2.52 and 6.67 W/minute for the wave height of 15 and 20 cm, respectively. In non-fixed base case, the EPO maximum value got from RF type at 1.81 and 6.21 W/minute for the wave height of 15 and 20 cm, respectively. RF type gave the EPO minimum value in another case. On the other hand, the PF type gave the value of EPO in the middle range for both cases about 1.93 and 5.63 W/minute for the wave height of 15 and 20 cm, respectively. Moreover, the PF type had the most regularity of EPO and generator efficiency. Hence, PF type was an appropriate floater for electricity production by wave energy.

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Subsurface fault investigation in Chiang Rai province, northern Thailand by integrated geophysical surveys.

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A magnitude 6.3 earthquake, the biggest instrumentally recorded earthquake in Thailand, occurred in Chiang Rai Province on 5 May 2014 and caused wide damage in the affected area. The earthquake generated numerous aftershocks that could portray the location of the fault plane beneath the ground. In this work, we conducted integrated geophysical surveys consisting of 2D seismic reflection and 2D resistivity imaging surveys to explore for active faults that could have caused this earthquake. A seismic reflection survey line with a total length of 3,750 metres and resistivity survey with a total length of 1,975 metres were conducted along the Chiang Rai earthquake's aftershock locations. The subsurface fault geometry was imaged from this integrated geophysical survey. Numerous subsurface discontinuities detected from both seismic reflection and 2D resistivity imaging survey were interpreted as potential faults along the survey line with depths from a few meters to around 500 metres. These subsurface discontinuities correspond well with the aftershock locations which could suggest a fault rupture plane.

A014: Environment (Poster) / 461

Recurrent Geomagnetic Storms and Equinoctial Ionospheric F-Region in the Low Magnetic Latitude: A Case Study

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This paper analyses a case study of 27-day recurrent geomagnetic storms (RGSs) and the ionospheric F-region over Peruvian, Ascension Island, and Port Stanley during vernal equinox in 2006. The RGSs are categorized into High-Intensity Long-Duration Continuous AE Activity (HILDCAA) and non-HILDCAA cases. The solar wind plasma, Ionosonde, and magnetometer data are used. The results revealed that in both cases prompt penetration electric field and disturbance dynamo electric

field (DDEF) control the ionospheric plasma and affect nighttime spread-F that disturbs the HF-radio communications in equatorial and southern crest of equatorial ionization anomaly (EIA). The spread-F at magnetic equator was delayed, more predominant, and last longer than at the southern EIA. DDEFs and thermospheric winds persist in the recovery phase of storm with stronger ones can inhibit the spread-F.

A014: Environment (Poster) / 469

Fabrication hydrogen generation system from CNT/Al application backup power of PEMFC stacks

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This research fabrication hydrogen generator and effects of hydrogen gas from aluminum and hydrogen production the reaction between activated aluminum and water has been investigated. The effect of different parameters such as water aluminum ratio, CNT and the activation of NaOH into the aluminum particles and pellets nanotubes/aluminum composite with pressure ratio. Reactor hydrogen generation consists of NaOH tank outside diameter 8 cm thick 0.5 cm high 15 cm reactor tank, filter cylinder and gas replaces the water tank. By each part wide 3 cm long 4 cm high 8 cm. The result rate and yield of hydrogen production from the reaction between activated aluminum and water has been investigated. The effects of different parameters such as water, aluminum ratio and aluminum particle size are being experimented with. The in-house developed aluminum activation method involves 0-5 v% CNT of the NaOH-based activator which is diffused into the aluminum particles. Hydrogen production rates in the range of 500- 700 ml/min/g Al, at a yield of about 90.01%, depending on operating parameters, were demonstrated. The work studied the application in proton exchange membrane (PEM) fuel cells in order to generate green electric energy, demonstrating theoretical specific electric energy storage.

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Physical Properties and Micro Structure of Fuel Pellet Made from Part of Tree in Southern Thailand

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Biomass pelletization is the basically technique to improve raw biomass properties which tend to provide the enhancement of durability and energy density. There are plentiful of raw biomass resources around the world which divided into two groups; woody and non-woody, that has individual advancement. The present study is the evaluation of woody pellet quality which made from part of common tree in southern Thailand, which are para-rubber sawdust (PS), branches and leaves of she oak (*Casuarina equisetifolia*) (SB and SL) and white samet (*Melaleuca cajuputi*) (WB and WL). The pelletization process was conducted in a single unit pelletizer at compressive temperature and pressure of 130oC and 450 psi, respectively. The higher heating value, compressive strength, moisture

content and density of pellet samples were determined to characterize the physical properties. It was found that, the best higher heating value, compressive strength and density were received from WL, CB and WL, respectively. In addition, scanning electron microscope (SEM) images of all pellet samples were proposed to characterized the bonding mechanism.

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Effects of clouds on solar radiation at Songkhla.

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The characteristics of clouds and its relationship with solar radiation are analyzed in this paper. In this research SR03 pyranometer was install at SKRU in Songkhla (7.09° N, 100.36° E) in order to measure solar radiation and clouds data from Songkhla TMD. The results from a six-month period (16 January 2017 – 30 June 2017) showed the relationship of clouds type and solar radiation, low clouds (Cu, Cb) were impact to decreases solar radiation intensity more than high Clouds (Ci, Cs).

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Heat Production of Radioactive ²³⁸U ²³²Th and ⁴⁰K in Thung Nui Hot Spring Rocks Area, Satun Province Southern of Thailand

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The heat generation from the radioactivity of ²³⁸U ²³²Th and ⁴⁰K of rocks in Thung Nui hot spring, Satun Province Southern of Thailand were study. The results of this research were used the develop of hot spring for ability renewable energy. The rocks sampling were collected outcrop nearly hot reservoir area. After sample grinded the radioactivity value of ²²⁶Ra ²³²Th and ⁴⁰K were measured by gamma spectrometer. It was found that the radioactivity value of ²²⁶Ra ²³²Th and ⁴⁰K in granite Triassic age and limestone Ordovician age rocks were 0.85 ppm 0.85 ppm and 0.18 % and 0.12 ppm 0.15 ppm and 0.04%, respectively. In addition, Heat Energy from Radioactive Isotope content; of ²³⁸U ²³²Th and ⁴⁰K, in granite and limestone rocks around Thung Nui Hot spring was 4.95 μW/m³ and 0.78 μW/m³, respectively.

A014: Environment (Poster) / 618

Study of Z-R relationship among different topographies in Northern Thailand

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Topography can affect climate. Different topographies have different climates. Rainfall in each area varies by topography. Northern Thailand has been chosen as a study area due to its various topographies such as ridge, flat, plain and valley. This research studies reflectivity data and rainfall rate.

Z-R relationship is a relationship between a radar reflectivity (Z) and a rainfall rate (R).

Z-R relationship can be used to determine characteristics of precipitation and rainfall and can be applied in hydro-meteorological model to forecast the weathers. Data are from Omkoi Radar Station, covering the area of 240 kilometer around the station. Further, daily rainfall data has been gathered from Meteorological Department of Thailand.

In this study, topographies are classified by Topography Position Index, showing highland, flat and valley. The results show that the empirical relations of rainfall rate and reflectivity measured by radar vary among different topographies which are highland, flat and valley i.e $Z = 94R^{1.5}$,

$Z = 137R^{1.5}$ and $Z = 143R^{1.5}$ respectively. The data indicates that if a parameter is low, the cloud is cumulonimbus. If a parameter is high, the cloud is nimbostratus. The variety of rain-cloud type and Z-R relationship also varies by topography.

A014: Environment (Poster) / 636

Evaluation of Southwest Monsoon Change over Thailand by High-resolution Regional Climate Model

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The 5x5 resolution Non-Hydrostatic Regional Climate Model (NHRCM) data from Meteorological Society of Japan is used to evaluate the south-west monsoon season that affects to Thailand during mid-May until mid-October in each years. Bulk-type cloud microphysics, Kain-Fritsch convective scheme, Mellor-Yamada-Nakanishi-Niino level 3 PBL scheme, clear-sky radiation scheme and Hirai-Ohizumi land surface scheme are used as the boundary conditions to drive the climate model under RCP 8.5 increasing of CO₂ condition. This research is included of 2 time periods, base part (1981 – 2000) and future part (2080 – 2099), to estimate changes of the onset and the end of south-west monsoon season over Thailand by considering the changes of 2 variables, average wind vector and cumulative precipitation in consecutive 5 days (penta day). Furthermore the rain-break phase, less precipitation ranges during the south-west monsoon season, has been added and showed the variation in each years.

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A Study of the Efficiency of Charcoal Briquettes from *Canarium Sabulatum* Guillaumin and *Xylia Xylocarpa*

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Abstract

This research aims to produce charcoal briquettes from *Canarium Sabulatum* (*Canarium Sabulatum*: tapioca starch) at the ratio of 8:2 and from *Xylia Xylocarpa* at the ratio of 7:3 (*Xylia Xylocarpa*: tapioca starch). The method that is used in this research is a cold press process by using a screw extruder that is connected with a 3.5 horsepower electrical motor. The finished charcoal briquettes of this method are compared with another finished charcoal briquette that uses a different emulsifier by analyzing thermal energy, amount of ashes, density, burning time, and a pattern of charcoal crackle. The analysis helps to determine which ingredients are the best for producing the best charcoal briquettes.

The result found that the production of charcoal briquettes from *Canarium Sabulatum* and *Xylia Xylocarpa* in both ratios results in briquettes with smooth surface, is completely dry, and is firmly formed in a bar shape. The thermal energy analysis showed that the charcoal briquettes that were mixed at the ratio 8:2 has the maximum thermal energy at 25.917 MJ/kg and pass Thai Community Products Standards (TCPS 238/2547) which indicated that the thermal energy must not be less than 5,000 calories/ gram or 20.920 MJ/kg . The density is also calculated and it was found that the charcoal briquettes from *Xylia Xylocarpa* at the ratio 7:3 has the best density at 735.74 Kg /m³. It is similar to a previous research that stated the density of charcoal briquettes must not be more than 0.8 g/cm³ or 800 kg/cm³. In regard to the amount of ashes, it showed that the charcoal briquettes from *Canarium Sabulatum* and *Xylia Xylocarpa* in both recipes have more ashes than the previous research. The burning time showed that the charcoal briquettes from *Canarium Sabulatum* at the ratio of 8:2 has the most burning time which is 326 minutes and is similar to the previous research. The previous research stated that the burning time of the charcoals should last more than 60 minutes. The last analysis regarding the pattern of charcoal crackle showed that the charcoal briquettes from *Canarium Sabulatum* and *Xylia Xylocarpa* in both recipes have no crackle and good quality according to the Thai Community Products Standards (TCPS 238/2547).

A014: Environment (Poster) / 642

Building a Charcoal Extruder by using Bicycle Power

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Abstract

The purpose of this research is to build a charcoal extruder by using a bicycle. The extruder is 0.73 meters in width, 1.75 meters in length, and 1.30 meters in height. It operates in the same way as pedaling a bicycle. The ingredients to make charcoals consist of charcoal powder, tapioca starch, and water at a ratio of 7:3 which is 7 parts of charcoal powder and 3 parts of tapioca starch. Pedaling the bicycle is an initial power to compress the mixed ingredients and deliver to the cylinder compression. Then, the extruder will perform a compress operation and finish the final product which is a charcoal. The diameter of the charcoal briquettes is 10 centimeters. After that, the timer is set for compressing the charcoals for 10 minutes, and then the moisture in the charcoals is eliminated by sun drying. The research also aims to find a physics mechanical property which is to find the density of the charcoal briquettes. It is also to find out daily production capacity of the extruder by using regular ingredients which are charcoal powder and tapioca starch to produce charcoal briquettes.

The results showed that the Bicycle Powered Charcoal Extruder can compress charcoals at the mean value of 0.964 kilograms, which means that the production capacity is 34.704 kilograms per day. According to the time reckoning for 10 minutes, the extruder is able to produce charcoal briquettes in a hexagonal prism shape with a diameter of 3 centimeters. The charcoal briquettes have density of 412.30 kg/m³ and the production cost is 4,260 baht.

Keywords: Charcoal Briquettes, Powered Bicycle

A014: Environment (Poster) / 643

Comparison Study of Efficiency and Property of Fuel Briquette by Electrical Machine by Motor and Hand Machine Using Bicycle

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Abstract

This study is comparison between fuel briquette from electric machine using motor and hand machine using bicycle. The briquettes from electric machine are 3.5 HP. The material was wooden charcoals which were grinded by grinder. The ratio was 2,000 g of grinded charcoal and 500 g of Tapioca flour (4:1) and water. Those components were mixed to made briquettes by electric motor and bicycle process. The time was record and the fuel was exposed to sun for getting rid of moisture. Calorific value testing was made using Cal 2k e2k (Bomb Calorimeter). And, mechanical property was calculated by finding density, the length of time when the fuel was lit and completely burnt out was also recorded.

It was found that making briquette using electric motor spent 4.29 minutes and using bicycle process spent 4.50 minutes. The percentage of difference in producing time was 4.79% the heating value of fuel from electric motor and bicycle process were 22.68 MJ/KG and 23.34 MJ/KG respectively. The percentage of difference in heating value was 2.87%. And, the density of briquette from electric motor and bicycle process were 907.43 Kg/m³ and 838.57 Kg/m³ respectively. The percentage of difference in density was 7.89%. The igniting period of those from electric motor and bicycle process were 6 minutes and 4.33 minutes. The percentage of difference in igniting period was 32.33%. And, the burning period of those from electric motor and bicycle were 5.17 hours and 4.24 hours respectively. The percentage of difference in burning period was 19.76%.

Keywords: electric machine by motor / hand machine using bicycle / fuel briquette

A014: Environment (Poster) / 651

Rainfall Estimation from Radar in different seasons over Northern Thailand

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Thailand was located on way though of tropical cyclone were formed in South China Sea or Pacific ocean and move to northeast of Thailand. The prevail storm in Thailand often downgraded to tropical depression. Northern Thailand has a tropics climate into three seasons. Rainy (May – October), Winter (October – February) and Summer (March – May). Averages rainfall around 1,230 mm/year received by the influence from two types of monsoon winds. Northeast monsoon, brings a cold and dry air from China to cover the major part of Thailand. And Southwest monsoon, brings the warm moist air from Indian Ocean towards Thailand causing abundant rain over the country.

The objective of the research is to evaluate Z-R relationship ($Z = aR^b$) for rainfall estimation in different seasons. This study use reflectivity data from Omkoi radar station in Chaing Mai Thailand and rainfall data in radius of 240 km from Omkoi weather radar station from Thai Meteorological Department. Method for matching reflectivity data (Z) and rainfall rate (R) relationship are PMM (Probability Matching Method). We find that the Z-R relationship in Rainy (May – October) is $Z =$

$103.83R^{1.51}$ and the Z-R relationship in Non- rainy (November – December, January – April) is $Z = 102.18R^{1.46}$. For the same rainfall intensity, reflectivity value in non – rainy season is higher than in the rainy season. This research shows that each monsoon causes a different characteristics of rainfall. In Rainy, Thus rainfall estimation for each monsoon should be based on different Z-R relationship for more accuracy.

A014: Environment (Poster) / 655

Comparison of Spatial rainfall amount from Meteorology Radar and Ground Station over Chiang Mai province

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This study aims to express a comparison of spatial analysis of rainfall between meteorology radar of Northern Royal Rainmaking Operations Center, Department of Rainmaking and Agricultural Aviation and meteorology radar from Northern Meteorological Center, Meteorological Department and Ground station by Northern Meteorological Center of Chiang Mai. Geographic Information System (GIS) has used to reveal the daily rainfall distribution, and compare with the daily rainfall of Omkoi radar, Chiang Mai province and Lamphun radar, Lamphun province. Spatial analysis was considered from Hot Spot to find relationship of rainfall between ground and radar stations. The data set of March 4th, June 10th and August 10th, 2013 were analyzed by using the Kriging method which consisted of 4 sub-methods; Spherical, Circular, Exponential and Gaussian. The data set were obtained from daily rainfall of 83 meteorological stations in the 6 provinces included Chiang Mai, Lamphun, Lamphang, Chiang Rai, Mae Hong Son and Tak. And the meteorology data from Omkoi and Lamphun radar stations were evaluated by the Mean Absolute Error (MAE) and Root Mean Square Error (RMSE).

The result shows that the spatial distribution of rainfall from ground station on March 4th could be analyzed by the Gaussian method as the result was 9.44 mm/day (MAE), and 8.20 mm/day (RMSE), while in June 10th; as the result from MAE was 21.36 mm/day and RMSE was 20.31 mm/day. Where as in August 10th, the result from Exponential method was 22.07 mm/day (MAE) and 22.10 mm/day (RMSE). And the rainfall distribution of Omkoi radar station on March 4th, by Gaussian analysis was 3.37 mm/day (MAE) and 6.74 mm/day (RMSE), while on June 10th, the result from Circular method was 0.41 mm/day (MAE) and 0.70 mm/day (RMSE), whereas on August 10th, the result from Gaussian method was 3.20 mm/day (MAE) and 3.68 mm/day (RMSE). Finally, the rainfall distribution of Lamphun radar station March 4th, by the Circular method was 0.87 mm/day (MAE) and 0.79 mm/day (RMSE), while on 10th of June, the result from Circular method was 1.47 mm/day (MAE) and 1.24 mm/day (RMSE), and on August 10th, by the Gaussian method was 2.43 mm/day (MAE) and 1.80 mm/day (RMSE). The result from determination of rainfall distribution by hotspot method was shown an inadequate correlation between an amount of rainfall from the surface and radar stations.

Key word: Meteorology radar, Rainfall, Kriging, Spatial analysis

A014: Environment (Poster) / 658

Study the Correlation between Solar Storms and Earthquakes

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Study the number of sunspots from the National Oceanic and Atmospheric Administration; NOAA and events of earthquake from Meteorological Department Thailand. Determine the relationship between astronomical and geological. The solar storm will occur and lost is solar cycle about 11 years, whereas events of earthquake will occur continuously. It may not be possible to indicate the earthquakes associated with solar storm.

A014: Environment (Poster) / 692

Estimation of attenuation coefficient of solar radiation in the atmosphere of Thailand

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The estimation of the attenuation coefficient of solar radiation in the atmosphere were used solar radiation data on a cloudless day. The data were collected from four measuring stations located in Chiang Mai, Ubon Ratchathani, Bangkok, and Songkhla during the years 2011-2015. Then, the relationship between the attenuation coefficient from solar radiation data and the surface data (air temperature, relative humidity and visibility data) in a mathematical model was investigated in this paper. The result showed that the relationship had a relatively high level of reliability. The attenuation coefficient was nearly equal to the value from the model. The attenuation coefficient from 85 meteorological stations across the country was calculated from the model. The result showed that seasonal change of the attenuation coefficient was high in the dry season and low in the rainy season.

A014: Environment (Poster) / 699

Energy Consumption and quality attributes for drying postharvest of dragon fruit (*Hylocereus undatus*) following disinfesting hot air treatments

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Hot air drying is one of the simplest drying methods with low investment and operating costs. In this work, energy consumption and quality attributes for drying postharvest of dragon fruit (*Hylocereus undatus*) were studied. Energy consumption, moisture content, color and sensory evaluation were measured for drying with a hot air dryer. Drying experiments of freshly dragon fruit were conducted at different levels of drying air parameters including temperature ($T= 70, 80$ and 90°C), velocity 0.5 m/s and relative humidity 40% . The result found that the drying rate increased with drying temperature, enhanced the drying rate and reduced both drying time by 110 min (46%) and specific energy consumption by 90°C water removed (72%). One of the best indices for explaining color changes of the product during processing is total color difference, It can be seen that L , a and b^* values increased with drying temperature. Sensory acceptability for the product dried under 90°C ,

velocity 0.5 m/s and relative humidity 40% were comparable to that of the reference (freshly dragon fruit).

A014: Environment (Poster) / 523

Estimation solar radiation in Thailand using Angstrom-Prescott model and Interpolation empirical coefficients

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Angstrom-Prescott model, $H=H_0 [a+b(s/S)]$, was estimated solar radiation for 11 meteorological stations in Thailand. The empirical coefficients (a,b) were calculated by using the least square model. Statistical values, Root mean square error (RMSE) and Correlation, were examined the estimated solar radiation with the measuring. The empirical coefficients were interpolated by using geographic information system (GIS). In the results, the statistical tests shown Angstrom-Prescott model is good performance to estimate solar radiation in Thailand as error is in 3-7 percent and the least square method is suitable for computing empirical coefficients. The interpolation of empirical coefficients can be calculated in every region in Thailand.

A014: Environment (Poster) / 539

Grain size and moisture content effects soil sample properties in portable X-ray fluorescence analysis of geological samples

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The elemental compositions measurements of the geological samples using portable X-ray fluorescence (pXRF) technique in the laboratory were studied. The influences of the grain size and the moisture content of the samples on the pXRF analysis were also investigated. The pXRF was used to determine the major (Al, Ca, Fe, K, Mg, Si and Ti) and minor (Mn, Nb, Pb, Rb, Sr, Th and Zr) elements in the geological samples with different depths collected from Phang-nga province, Thailand. Seven reference materials were utilized to calibrate the analytical method. The calibrated values were strongly correlated to that reference values ($R_2 > 0.95$) for Al, Ca, Fe, K, Mg, Mn, Rb, Si, Sr, Th, Zr except for Cu, Nb, Ni, P, U, V, W, Y, Zn. The results showed that both grain size and moisture content had significant effect on the elemental concentrations measured by pXRF. The decreasing of grain size resulted in an increase the elements concentrations. While the moisture content in the sample increased with decreasing of the elements concentrations. The measured elements were Si (22.03 – 25.79 wt%), Al (17.39 – 21.38 wt%), Fe (4.39 -7.41 wt%), Ti (0.70 – 1.23 wt%), Nb (47 – 99 mg/kg), Rb (50 – 99 mg/kg) and Zr (499 – 900 mg/kg). These elements concentrations were measured by pXRF under the optimum conditions, the grain size of the sample of <75 μ m and the moisture content in the sample of less than 1 wt%, as well as were good agreement with that WDXRF results. For Ca, K, Mg and Mn, their concentrations were lower than detection limits of the pXRF.

A014: Environment (Poster) / 540**Mathematical Model Suitability for Thin-Layer Drying of Chiangda Herbal Tea (*Gymnema inodorum* Lour.) under Modified Greenhouse Dryer****Author:** Mali Sarobol¹**Co-authors:** Wanida Pharanat ; Pornpisanu Thammapat² ; Suriya Ruttanasuriyakorn³ ; Atthachai Inta³ ; Preedok Sarobol¹ *Rajabhat Mahasarakham University*² *80 Nakhonsawan Road, Muang Maha Sarakham*³ *Rajabhat Maha Sarakham University***Corresponding Author:** sanawong_14@hotmail.com

Chiangda herbal tea is an herb from Thailand that has a long and varied history in traditional medicine, it has been used in ayurvedic medicine for several centuries as a safe and natural way to help regulate sugar metabolism. The objective of this study was to evaluate the influence of drying of Chiangda herbal tea with modified greenhouse dryer. Drying experiments were performed at an air temperature of 50°C was investigated in dryer. The research was to determine on change of color, antioxidant activity, sensory evaluation and mathematical model suitability for thin-layer drying.

The research found that trend of color change of Chiangda herbal tea freshly and dried on the brightness values (*L*), *green value* (*a*) and yellow (*b**) values were decreased after drying. Highlight of this research the Chiangda herbal tea dried by modified greenhouse dryer has increased antioxidant activities. The sensory evaluation scores were acceptable in all experimental conditions. The Wang-Singh equation was found to satisfactorily describe the drying behavior Chiangda herbal tea, with good agreement obtained with the experimental data the highest value of R^2 (0.9993-) and the lowest values of MBE (-0.0007-0.00412) respectively. The moisture transfer from Chiangda herbal tea was describes by applied the Fick's diffusion model. The effective moisture diffusivity varied from 9.517×10^{-11} to 2.606×10^{-10} m²/s and increased with the temperature. An Arrhenius relation with an activation energy value of 24.91 kJ/mol expressed effect of temperature on the diffusivity.

A014: Environment (Poster) / 541**Investigation Effective Moisture Diffusivity and Activation Energy on Convective Hot Air Drying Assisted Extraction of Dragon Fruit Slices****Author:** Mali Sarobol^{None}**Co-authors:** Preedok Sarobol ; Wanida Pharanat ; Suminya Teeta**Corresponding Author:**

Good drying system is evaluated by its efficiency in removing the moisture content of products to a certain level and at the same time decrease the quality degradation that occurs in drying process. The objective of this study was to investigation effective moisture diffusivity and activation energy on convective hot air drying assisted extraction of dragon fruit slices. Drying experiments were performed under 3 temperatures of 60, 70 and 80°C, air velocities of 1.0 m/s and two thickness of thin layer of 3 and 5 mm. Investigate the effect of drying conditions on drying kinetics and qualities attributes of dragon fruit slices, namely, antioxidant activity determined by DPPH methods and total color changes (ΔE) of dried dragon fruit slices. The results show that the drying time decreased with increased in drying temperature but increased with the decreasing of thin layer thickness. The highest effective moisture diffusivity thickness thin layer of 3 mm was found to be 3.55×10^{-9} m²/s and thickness thin layer of 5 mm was found to be 9.21×10^{-10} m²/s, effective moisture diffusivity increased with the temperature. An Arrhenius relation with an activation energy showed that a higher value of thickness of thin layer of 3 mm. The experimental results showed that higher

drying temperature led to higher effective diffusion coefficient, antioxidant activity and total color changes.

A014: Environment (Poster) / 560

Impact of Phosphate Fertilizers on the Uranium and Thorium of Cultivated Soils Profiles, Kamphaeng Phet, Thailand

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Phosphate fertilizers contain uranium and thorium isotopes due to impurities in the phosphate rock used for fertilizer manufacture. Long term application can significantly accumulate and reach undesirable concentrations in agricultural soils. The presented study determined the ²³⁸U and ²³²Th in the four cultivated fields, one forest reference site and five phosphate fertilizers collected from Kanu Woraksaburi district, Kamphaeng Phet province. The uranium and thorium isotopes were measured by using radiochemical analysis and alpha spectrometry. The radionuclides in four arable soils revealed that the in more clayey soils were higher than in more sandy soils and dramatically decreased along the depth of both soil profiles. The cultivated soils were significantly higher than the reference site where no fertilizers were applied. The values were compared with available reported data from other countries in literature.

A014: Environment (Poster) / 561

Potential effects of rain intensity and evaporative loss on the stable isotope compositions of surface water in Kamphaeng Phet, Thailand

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To understand the hydrological regime of the surface water in Kanu Woraksaburi district, Kamphaeng Phet province, the rainwater and surface water were analyzed on the isotopic variability of hydrogen ($\delta^2\text{H}$) and oxygen ($\delta^{18}\text{O}$) collected over 3 years from 2015-2017. Surface water evaporation was verified on the basis of the isotope composition results. Based on a total of 213 rainwater samples and 152 surface water samples, stable isotope analysis was carried out and the Local Meteoric Water Line (LMWL) was defined as $\delta^2\text{H} = 7.703 \delta^{18}\text{O} - 1.333$, $R^2 = 0.952$ while the Local Evaporation Line (LEL) of surface water was $\delta^2\text{H} = 5.318 \delta^{18}\text{O} - 17.618$, $R^2 = 0.935$. It was observed that the isotope compositions of surface water have a linear relationship with precipitation ($R^2 = 0.935$). However, the small slope of 5.318 indicated the enrichment effect of evaporation. Depleted isotopic compositions of surface water revealed in wet season and enriched $\delta^2\text{H}$ and $\delta^{18}\text{O}$ were found in dry season with less precipitation, lower humidity and higher temperature. Presented data imply that the isotopic composition of surface water in semi-arid area of Kamphaeng Phet is predominantly due to rain intensity and evaporative loss.

A014: Environment (Poster) / 569

Preparation of the CsPbBr₃ perovskite film for using as the light absorber in the hole-free transport materials for perovskite solar cells

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CsPbBr₃ perovskite films were prepared by using two-step method and using as an active material in the hole-free transport materials for perovskite solar cells. The CsPbBr₃ perovskite films were coated on the F-SnO₂ (FTO) conductive substrate by the spin coating technique. To prepare CsPbBr₃ perovskite film by the two-step method, firstly, the PbBr₂ film was coated on the FTO substrate by spin coating technique and then PbBr₂ film was immersed in CsBr solution at 50 °C for 20 min. Finally, the CsPbBr₃ film was annealed at 300 °C in air for 10 min. The surface morphology and the film thickness of CsPbBr₃ perovskite films were characterized by the scanning electron microscope (SEM). The crystalline structure and light absorption properties of the CsPbBr₃ film were investigated by the x-ray diffraction (XRD) and UV-visible spectroscopy. The XRD result shows that the CsPbBr₃ crystals are pure perovskite phase. The energy bandgap (E_g) of CsPbBr₃ film investigated by the UV-visible technique is found about 2.3 eV. The CsPbBr₃ perovskite solar cell sample shows the solar cell efficiency of 1.4%.

strong text

Key Words : perovskite solar cells, CsPbBr₃, hole-free transport materials

A014: Environment (Poster) / 582

A study of relation between Enso index and the change of rainfall in Thailand

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The aim of this research is to study relation between Enso index and the change of rainfall in Thailand. The data used in this research was Oceanic Nino Index (ONI) from National Oceanic and Atmospheric Administration (NOAA), which is used to indicate ENSO event, and rainfall data from Meteorological department. The periods of rainfall data used one 1983 to 2012, in 4 regions (North, South, Central and Northeast) from five stations in each regions were chosen for analysis. Afterwards, the change in rainfall from 30th years rainfall average for each ONI case were studied, in 3 time series, JFM (January, February and March) MAM (March, April, and May) and OND (October, November, December). We exclude data from rainy season because the effect of ONI was overwhelmed by the effect of monsoon season. The result show that in Thailand. If ONI indicated El Nino event, rainfall will be lesser than average, and if ONI indicated La Nina event, rainfall will be more than average, in all three time series. And southern region has largest rainfall anomaly compare to other region.

A014: Environment (Poster) / 594

Study of Radar Rainfall Estimation using Geographic Information Systems over Chiang Mai Province

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Weather Radio Detection and Ranging or Weather Radar is an equipment used for detecting the position and direction of atmospheric movement. Weather Radar was calculated the time travel of electromagnetic wave which sent and received to the objects. The radar reflectance could be estimated amount of water vapor in the cloud, but it was not exact value of surface rain water. Therefore, to examine the relationship and trend between rainfall from weather radar and surface rain gauge station, we use Z-R relationship equation to calculate rainfall from weather radar and compared with rain gauge station. The study area is Chiang Mai province and the chosen time period were as March 4th, June 10th and August 10th in year 2013. The data acquisition of rainfall values measured by surface rain gauge station from Northern Meteorological Center and the weather radar map from Lamphun radar station covered 6 upper-north provinces (83 rain gauge stations) which included of the weather radar map from Omkoi radar station covered 63 rain gauge station. The results shown that consistency coefficients of determination (R-Squared) of the rainfall between from rain gauge station and calculated from weather radar map. The interpolation and hot spot analysis were shown the similar relationship and trend of the rainfall from both places in term of spatial analysis. The rainfall values on March 4th was about 0-39 mm/day, 0-4 mm/day, and 0-21 mm/day from rain gauge station, Lamphun, and Omkoi radar station, respectively. And the rainfall values on the 10th of June was about 0-84 mm/day, 0-9.6 mm/day, and 0-4.2 mm/day from rain gauge station, Lamphun, and Omkoi radar station, respectively. Whereas the rainfall values on the 10th of August was about 0-107 mm/day, 0-10 mm/day, and 0-4.8 mm/day from rain gauge station, Lamphun, and Omkoi radar station, respectively.

A014: Environment (Poster) / 596

Variability in the Frequency of Temperature over Thailand using Wavelet Transform

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Abstract. Temperature is one factor affecting the yields of rice which is the main food crop of Thailand. Therefore in this research we investigate the variability in the frequency of temperature over Thailand from 1901 to 2016 using wavelet transform. In wavelet analysis we calculate the wavelet power spectrum, the global wavelet power spectrum and the scale average wavelet power. We also study the relationship between the temperature over Thailand and the sea surface temperature (SST) anomalies monitoring along the equator at the location the Niño3 region. The results show that the main frequency of oscillation of temperature over Thailand is 1 year the same as another natural climate. The oscillation frequency of period 6 month also observed although it does not occur every year. The analysis of temperature anomaly shows that the high wavelet power occurred within the period 24-84 months band and the 120-130 months band. The wavelet power spectrum of the STTNiño3 shows the similar pattern as of the temperature over Thailand. The oscillation frequencies of 1 year and the period of 24-84 months band are also observed. These frequencies are confirmed by the global wavelet power spectrum. As seen from the scale-average time series, not all El-Niño have the same effect on temperature over Thailand. The temperature in Thailand will be high in the years that the El Nino activities are strong. The knowledge of variation in the frequency of temperature over the period of time will help the farmer and the government in better predicting, planning and preparing for the change in temperature beforehand.

Keywords: temperature, frequency, wavelet, power spectrum, oscillation, El Niño

A015: Atomics (Poster) / 792

Correlations of Dynamics Viscosity and Kinematic Viscosity of Fatty Acid from Gibbs Energy Additivity Approaches

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Abstract.

Dynamic viscosity and kinematic viscosity are important physical properties of a liquid. In this work, correlation of dynamic viscosity and kinematic viscosity of fatty acids (FA) are correlated to the Martin's rule of free energy additivity for estimated kinematic viscosity and dynamic viscosity from their own equations. The proposed equations for estimating viscosity and density of FA are correlated to number of carbon atoms, number of double bond(s) and temperature. Data collected from literatures were used to validate, and support the proposed models. The proposed equations are easy to use and the estimated dynamic viscosity and kinematic viscosity values of FA at different temperatures agree well with the literature values. The average absolute deviation of dynamic viscosity and kinematic viscosity of FA at 297.05-394.25 K are 4.14 and 4.37, respectively. The estimated outside temperature between 288.15 and 363.15 K may be possibly estimated by this model but accuracy may be lower

A015: Atomics (Poster) / 775

Gibbs Energy Additivity Approaches in Estimation Surface Tension of Fatty Acids

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Surface tension is important to ensure the efficiency of industrial operation units involving chemical reactions and extractive processes that use these compounds as solvents. In this work, correlation of surface tension of fatty acids (FA) is correlated to the Martin's rule of free energy additivity for estimated surface tension. The proposed equations for estimating surface tension of FA are correlated to number of carbon atoms (nc), number of double bond(s) (nd) and temperature (T) to $r=69.05-1.3614nc-0.13895T+0.005209nc+6.24nd-0.01612nd$. The proposed equations are easy to use and the estimated surface tension values of FA at different temperatures agree well with the literature values.

A015: Atomics (Poster) / 570

Characterization of Focus-Beamed Trap

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We investigate the properties of the focus-beamed magneto-optical trap (FBT) of Rb^{85} atoms, which provides more optical accessibility in contrast to typical magneto-optical trap (MOT). We have characterized the relations between dependent variables i.e. loading time, number and density of trapped atoms versus various trap parameters, e.g. laser intensities, detuning frequency etc. In this paper, we will discuss three distinctive features of the FBT comparing to those of a standard MOT. First, the atomic density showed sudden drop at cooling intensity of 4 mW/cm^2 and completely vanished at 8 mW/cm^2 . Second, the loading time appeared strongly dependent of the intensity of cooling beams but then developed a plateau over the magnetic field gradient greater than 15 G/cm . Third, the number of trapped atoms was found to be more sensitive to the intensity of repump beams than the cooling ones. Although the trap can capture fewer atoms comparing to the standard MOT, due to its asymmetric geometry, it offers an alternative trap configuration for preparing single atom.

A015: Atomics (Poster) / 564

The ionic dipole and quadrupole polarizabilities of magnesium

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The non-adiabatic core polarization is used to analyze the measured microwave transitions (B. J. Lyons and T. F. Gallagher, Phys. Rev. A 57, 2426 (1998)) to determine the $\text{Mg}^+ 3s$ dipole and quadrupole polarizabilities. From the calculation, the values of the $\text{Mg}^+ 3s$ dipole and quadrupole polarizabilities are $34.85(23) a_0^3$ and $78(20) a_0^5$, respectively.

A016: Magnetic and Semiconductor (Poster) / 729

The Residue Resulting from the Earth's Magnetic Field Cancellation Using Spherical Coils

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Current carrying spherical coils are used to generate the magnetic field to cancel the Earth's Magnetic Field (EMF) on an interesting spherical surface. The currents in the spherical coils, which minimize the residue from the EMF cancellation, are determined by the steepest descent optimization method. In this study, two configurations of the spherical coils are considered. Considering the separation between each plane of the current wires, one has equal spacing and the other has equal polar angle separation. Our primary goal is to achieve the maximum residue less than 5% of the EMF. We also compare the residue and power consumption between various number of wires ranging from 26 to 36 wires for the two configurations. Our results show that the maximum residue from the equal polar angle configuration is less than that from the equal spacing one for every number of current wires. However, the power consumption and the current variation among the wires are less for the equal spacing one (52 - 89 A) as opposed to the equal polar angle configuration (8 - 134 A). This allows us to group the currents distributed to the wires and thus requires less amount of power supplies.

A016: Magnetic and Semiconductor (Poster) / 709**Effect of Seed Layer on Growth of Rutile TiO₂ Nanorods****Author:** Aschariya Prathan¹**Co-author:** Duangmanee Wongratanaphisan¹ *Department of Physics and Materials Science, Faculty of Science, Chiang Mai University***Corresponding Author:** aschariya22@gmail.com

For achieving the high quality of titanium dioxide (TiO₂) nanorods, herein, we present a synthesis of rutile TiO₂ nanorods on a transparent conductive fluorine-doped tin oxide (FTO) glass substrate with seed layer by a two-step method. Anatase TiO₂ thin films were first precoated by spin coating and annealing, followed by the growth of rutile TiO₂ nanorods with a hydrothermal method. The crystallographic nanostructures and properties of the nanorods were investigated. XRD results demonstrate that seed layer was tetragonal anatase TiO₂ structure while nanorods had tetragonal rutile TiO₂ structure. Since the hydrothermal technique was conducted in medium acid, structure of nanorods was induced to form in rutile phase. The major characteristic orientation of nanorods on the seed layers was [002] and minor in (101) planes. FE-SEM results show that seed layer enhances the process to achieve vertical-aligned orientation of the TiO₂ nanorods, which contribute to develop electron transport rate and could play an important role in electron transport layer in high-performance Perovskite solar cell.

A016: Magnetic and Semiconductor (Poster) / 572**Thermal decomposition synthesis and magnetic properties of crystalline zinc oxide powders****Authors:** chalita wisetrinthong¹ ; kwanruthai wongsaprom^{None}¹ *student***Corresponding Author:** chalita430@gmail.com

Crystalline zinc oxide powders are prepared by a direct thermal decomposition of zinc nitrate hexahydrate in air at 500 °C for 2 h. The thermal behavior of zinc precursor compound was studied using TG-DTA analysis in order to define the ZnO formation temperature. The structure of the calcined sample was characterized by X-ray diffraction (XRD). The XRD result indicates that the sample has a pure phase with ZnO wurzite structure. The morphology and elemental composition have been identified through SEM and EDX analyses. The oxidation state of ZnO sample was investigated using X-ray absorption near-edge spectroscopy (XANES). The ZnO sample reveals ferromagnetic behavior with the magnetization of 0.50 emu/g at 15 kOe. Our results indicate that room-temperature ferromagnetism of ZnO is intrinsic.

A016: Magnetic and Semiconductor (Poster) / 549**Fabrication and magnetic properties of Co_{0.05}LaTi_{0.95}O₃ nanofibers****Author:** Wichaid Ponhan¹**Co-authors:** Sutparak Kadtajun¹ ; Inthuon Khetchompoo¹ ; Pornchai Chinnasa¹¹ *Rajabhat Maha Sarakham University*

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$\text{Co}_{0.05}\text{LaTi}_{0.95}\text{O}_3$ nanofibers with average diameter of 201 – 264 nm have been successfully fabricated by electrospinning method. The crystal structure of nanofibers calcined at 400 – 700 °C shows amorphous structure. The $\text{Co}_{0.05}\text{LaTi}_{0.95}\text{O}_3$ nanofibers calcined at 800 °C had cubic perovskite-type structure with secondary phase. The average crystallite sizes of nanofibers calculated from Scherrer's formula were found to be 8.6 nm. The nanofibers of $\text{Co}_{0.05}\text{LaTi}_{0.95}\text{O}_3$ calcined at 400 – 600 °C exhibit diamagnetic properties. The sample of nanofibers calcined at 700 and 800 °C revealed room-temperature ferromagnetism behavior with the highest magnetization of 2.6 emu/g observed in the sample calcined at 800 °C. It was found that the magnetization value increased with increasing calcination temperature.

A017: Statistical and Theoretical Physics (Poster) / 788

Benefits Driven Migration Between Agricultural and Industrial Sectors: Econophysics Modelling via Monte Carlo Simulation on Ising Spin Model

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The transition from agriculture towards manufacturing serves as a key feature in economic development in developing countries. In such the transition, there occurs a flow of laboring force from rural (agricultural) to urban (industrial) areas, resulting in the drop in agricultural GDP but the rise in industrial GDP. This substantially affects the economic structures as the rural to urban migration results in substantial changes in employment and living standards between rural and urban areas. Many economic models have been considered to explain population migrations. Among them, one of most successful model emphasizes on income differences between the agricultural and industrial sectors. This income mismatch could be treated as the 'chemical potential' which drives the flow of labouring masses between the two sectors. Incorporation with social interaction where people tend to stay with their closest ones, the model can be categorized as the ferromagnetic Ising spin model. With each state of the spin referring to a worker in each different sector, previous works usually rely on the nearest neighbouring model where in fact the spatial nearness of the spin does not relate to the close relationship among workers. Furthermore, to limit the relationship interaction only up to first or second nearest neighbouring spins in two-dimension is also ambiguous as each worker should have freedom to pick up friends' with intimacy. Therefore, in this work, we have used a dynamical Ising model to investigate agricultural-industrial migration. Instead of considering only neighbouring spins, the spins are allowed to interact with any other spins in the system in a random fashion, where average number of social interacting spins was varied. With Monte Carlo simulation, heat-bath algorithm, and the sectorial update based on difference in income/social benefits, emergent characteristics that are common in developing economies were found. For instance, with majority of population initially set in the agricultural sector, the temporal growth of industrial population as well as per capita income is evident. In addition, the population in these two sectors become stabilized when the equalization condition of average income per worker in both sectors is met. However, with increasing the number of social interacting friends, the growth rate in industrial population becomes smaller and the population in both sectors takes a longer time to stabilize. This is expected as a larger level of consensus usually slow down any rapid changes, so higher income benefit needs to be enhanced for faster driving the system to economic stability state.

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Herd Immunity Estimation of Flu-like Disease Spreading in SEIR Population: The Sociophysics Modelling via Monte Carlo Simulation on Discrete-spin model

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In this work, the disease spreading under SEIR framework (susceptible-exposed-infected-recovered) and agent-based model was investigated via discrete magnetic spin and Monte Carlo simulation. The defined systems were two-dimensional square-lattice-like, where the spins (representing susceptible, exposed, infected, and recovered agents) were allocated on lattice sites. Taking flu-like disease as a case study, the latent period was fixed at a quarter of infectious period. Then, the system size, the spin population density, and the infectious period were varied to observe its influence on uninfected population. In the simulation, each spin was randomly allocated on the lattice and interacted with its first and second neighbouring spins for disease spreading. The magnetization profiles, representing normalized agents in each state, were recorded. From the results, good agreement between the simulation and real spreading results was qualitatively evident. The uninfected susceptible (survivor) results can be categorized into 2 distinct phase depending on the values of infectious periods. The critical infectious period, which separates low and high survivor phases, was then extracted and power-law scaled with the population density. With this scaling formalism, one can use for specifying the overcrowd situation that conveys epidemic to pandemic, which may benefit epidemiologists and government for future health related policies issuance and deployment.

A017: Statistical and Theoretical Physics (Poster) / 454

First Principles Investigation of Structural Stability and Electronic Band Structure of CH₃NH₂BiI₃ for Lead-free Perovskite Solar Cell Application

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CH₃NH₃PbI₃-based perovskite solar cell continues to attract great attention because its power conversion efficiency has been increased rapidly, from 3.8% in 2009 to 22.1% in late 2017. However, the existence of the toxic Pb hindered further large-scale application. Recently, there are several Pb-free candidates that have been proposed. Among all promising candidates, the Bi-based perovskite could be a potential candidate in replacing the Pb-based one since the contribution from Bi 6s (instead of Pb 6s) near valence band maximum (VBM) may share the same characteristic such as the excellent hole transport properties. In addition, more electrons in frontier orbitals (6p) of Bi (compared to that of Pb 6p) are expected to introduce the stronger binding of Bi-I framework, which benefits structural stabilization. In this work, the Pb-free perovskite CH₃NH₂BiI₃ was considered and first principles density functional theory (DFT) was used to investigate its structural stability and electronic structures. The CH₃NH₂BiI₃ perovskite in orthorhombic structure (which is expected to be the most stable structure at the ground state) was used as an initial crystal structure for structural relaxation. From the results, the relaxed BiI₆ octahedral cage of the orthorhombic CH₃NH₂BiI₃ exhibits significant distortion with respect to PbI₆ octahedral cage of CH₃NH₃PbI₃. The formation enthalpy per unit formula (ΔH) of CH₃NH₂BiI₃ was found to be 0.13 eV lower than the total ΔH of CH₃NH₂ molecule and bulk BiI₃, indicating that CH₃NH₂BiI₃ is more stable and may be safe from getting decomposed into CH₃NH₂ and BiI₃ under small external perturbation. In addition, from the chemical potential diagram, it supports the equilibrium growth condition of CH₃NH₂BiI₃, i.e. synthesizable, while simultaneously prevents the occurrence of competitive compounds. From band structure calculations, CH₃NH₂BiI₃ has the band gap of 1.61 eV and low electron effective mass, which are comparable to those from CH₃NH₃PbI₃. However, the VBM was found to be mainly contributed by the electronic states from CH₃NH₂, instead of Bi 6s. It is relatively flat compared to the VBM of CH₃NH₃PbI₃, and thus has a larger hole effective mass. Since improvement of structural and electrical properties is usually desirable for development of novel Pb-free perovskite, our theoretical prediction on orthorhombic CH₃NH₂BiI₃, (with enhanced structural stability, synthesizability, small band gap, and low electron effective mass) suggests its capability to be another promising candidate in substituting the Pb-based perovskite solar cells.

A017: Statistical and Theoretical Physics (Poster) / 795

Traffic flow simulation through traffic light using cellular automata model

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The traffic congestion is a big problem in our country and in the world. Management of traffic becomes a very important issue. In this project, management of traffic light stop was studied with computer simulation. We simulated the traffic flow model under condition of a Cellular automata model using C programming. Our objectives are to simulate traffic flow through traffic light using cellular automata model and to study the effects of the stop signs on traffic flow rate. A cell automata model based on microscopic discrete description which is discrete in time, space, and status. It does not require a specific formula. It is also suitable for computer simulation. According to our model, the road was designed as many cells and the car can be placed in each cell. The time of the system is defined in step time unit. In each step time, the appropriate position of each car in the system is calculated under the rule of our model then it is moved to new position. In the result, the flow rate of different traffic management in single-lane intersection with stop signal systems are compared. From our result, our traffic flow model can be used to show the position of the cars on the road in each step time and can be used to calculate the flow rate through traffic-light signal.

A017: Statistical and Theoretical Physics (Poster) / 691

The Effect of Heat Inducing Magnetic Instabilities on the Dynamic Hysteresis Characteristics in FePt thin-film: Finite Element and Monte Carlo Investigation

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In this study, the magnetization and hysteresis of thin film were study under the applying magnetic field and laser pulses by using the Monte Carlo and Finite Element method. The results show that the hysteresis loop will be existed when the frequency of applied laser pulse is a multiple integer time the frequency of magnetic field. If the frequency of laser pulse that is non-integer times the frequency of magnetic field, the hysteresis loop will not occur due to asynchronous between laser pulse and magnetic field. The existed hysteresis has two types are symmetric and asymmetric shape. The symmetric hysteresis has one coercivity value and has existed when the frequency of laser pulse is even integer times the magnetic field frequency. On the other hand, the asymmetric hysteresis has two coercivity values and has existed when frequency of laser pulse is odd integer times the magnetic field frequency. Moreover, the magnetic coercivity will varies depend on the frequency of laser pulse relate to the magnetic field and the highest temperature during heating cycle will decrease when the frequency of laser pulse is increased. These results indicate that the efficiency way of applied heat to reduce the coercivity should consider the frequency between the magnetic field and heat pulses during writing process which help to prevent the excessive heat usage.

A017: Statistical and Theoretical Physics (Poster) / 686

Stochastic Lagrangian Particle Simulation of Air Pollution Dynamics at a Mountain Base and Vicinity

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The air pollution studies usually scoped on the pollutant convection and diffusion from the emission sources. An emphasis on horizontal directions as how wide the range of pollution can spread out is a key parameter. The study domains are usually set at very large horizontal dimensions (xy -direction) compare with the vertical dimension (z -direction). In a recent work, the stochastic Lagrangian particle model considered turbulent diffusion coefficient being constants in the horizontal directions (i.e. K_x and K_y) because the study region was set in the urban area. However, for the region closes to the obstacle such as being situate near a mountain, the air flow is more complex and the turbulent diffusion parameters should be spatially dependent around the foothill. In this work, the air pollution transport was studied under the influence of the high turbulent diffusion in the region near the mountain. The pollutants transportation used Lagrangian particle models in the calculation. The turbulent diffusion coefficient was varied toward the mountain boundary by three kinds of functions are step function, linear function and exponential function. These kinds of variation functions were used as the variation model of horizontal turbulent diffusion coefficient K_x and K_y to compare with the non-variant or constant K_x and K_y . The results showed that the high concentration of pollution accumulated in different distance and existed further away from the mountain boundary. The highest concentration occurred differently in each function type, the highest concentration existed furthest in the step function and nearer in the exponential function. Whereas, the non-variant of turbulent diffusion coefficient caused the pollutant concentration is highly accumulated at the boundary due to the low turbulent diffusion.

A017: Statistical and Theoretical Physics (Poster) / 649

Traveling wave solution for a flux limited reaction-diffusion equation

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Reaction-diffusion equations can describe a wide range of transport processes in physical, chemical and biological systems. The solutions of this equations predict that the particle or population density evolves as the traveling wave with unlimited constant speed. As we know, the speed of sound is highest admissible value in a medium. However, this property is lost in the conventional reaction-diffusion equations. The flux limited reaction-diffusion equation is the new proposed model for removing this shortcoming. Unfortunately, the complete solution to this equation has not been well understood due to its complexity. In this research, we studied a flux limited reaction-diffusion model that is a variance form of the Fisher-Kolmogorov-Petrovsky-Piskunov (Fisher-KPP) equation. We found its analytical traveling solution in approximate form by using a perturbation method. We also solved the full equation by using an implicit finite-difference method for comparing with the analytical solution. The solutions of this equation, both analytically and numerically, could reveal more realistic physical properties of the reaction-diffusion model.

A017: Statistical and Theoretical Physics (Poster) / 587

Radiation reaction of a charged particle with the external rectangular force

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In this work We consider the equation motion of an accelerating finite spherical shell charged particle which brings to the Landau-Lifshitz equation. This equation show that an acceleration of charged particle depends on an external force and its derivative. We find the solution of the acceleration from external rectangular force. SO that we solve the velocity and position of the charged particle. As a result we compare with the equation of motion from the Abraham-Lorentz equation.

A017: Statistical and Theoretical Physics (Poster) / 460

Electronic and optical properties calculation of blue phosphorus/tetragonal ZnO 2D heterostructure using hybrid density functional theory

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Two dimensional (2D) materials have drawn a lot of attention due to the outstanding properties apart from their bulk counterpart. Since the discovery of the graphene, many 2D materials have been synthesized such as BN, MoS₂, WS₂, and ZnO. These new 2D materials open the opportunity in manufacturing the next generation nano-scale electronic devices. Recently, novel 2D materials, i.e. black phosphorus (black-P) and blue phosphorus (blue-P), were fabricated. The theoretical calculation predicted that blue-P has a wider band gap and higher hole mobility than those of the black-P. The band gap of monolayer blue-P is indirect while that of the black-P is direct. Nevertheless, both blue-P and black-P have poor structural stability under the presence of water and oxygen molecules. To improve their robustness on structural volatility, the blue-P(black-P)/hexagonal ZnO 2D heterostructure was suggested due to the strong chemical stability of the 2D hexagonal ZnO. Moreover, previous calculation showed that this heterostructure gives versatile properties and applications. For instance, it was found that the blue-P interfacing with hexagonal ZnO has indirect band gaps (with a type-II band alignment), but changes to direct band gap when applying external electric field. This then suggest its band gap tunable capability which is useful in the multifunctional device designing. In addition, in our previous work, the tetragonal ZnO monolayer was found to have higher electron mobility than that of the hexagonal ZnO, while their structural stabilities are comparable. Therefore, in this work, the 2D heterostructure of blue-P/tetragonal ZnO was studied and the electronic structures were extracted via hybrid density functional theory to investigate the ZnO structural effects. From the calculation, the results show that the blue-P/tetragonal ZnO 2D heterostructure has direct band gap and its energy gap is lower than that of the blue-P/hexagonal ZnO. The band structure also shows that the blue-P/tetragonal ZnO heterostructure has both high electron- and hole-mobility, which is useful for the charges transportation in photoelectric devices. The high electron-mobility was found to originate from the contribution of ZnO at the conduction band minimum (CBM). On the other hand, the high hole-mobility originates from the contribution of blue-P at the valence band maximum (VBM). Moreover, the blue-P/tetragonal ZnO 2D heterostructure was found to be more stable than that of the parent structures, which shows its potential for implementation in the nano-optoelectronic devices.

A01:Biological (Poster) / 816

Increasing efficiency in commercial sex reversal of tilapia with pulses electric fields

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This research had been extended from our previous project of electrical sex reversal for monosex-male Nile tilapia by using pulse-electric fields (Fish X-Change) to increase all-male sex reversal (MSR), survival rate (SR), hatching rate (HR) and cleaning cell surfaces during the hatchery process. In order to reduce the mortality rate and increase the survival rate, the effect of high-voltage pulse electric fields on tilapia's egg surfaces with various pulse waveforms of square pulse-electric fields, sequential exponential-pulse electric fields and ultrasound-immersion techniques combined with transient-pulse electric fields were examined through experiments. The optimized pulse-wave forms of the signal with periods (range of micro-second), number of pulses, amplitudes and appropriate suspending medium for electrical inductions were verified with simulations of theoretical electrical parameters. Verifications of experiments were made through SEM micrographs of cell surfaces before and after inductions with various electric fields waveforms, number of holes on the cell surface, hole density, main pore at the top, opened hole diameter (hole crater), sharpness and edge cleanliness. The amount of bacteria before and after electrical inductions were also investigated using staining technique. The results of hatching and survival rate were recorded in the first-week fry (from larvae to fry). For our first pilot experiment, all male sex reversal rates of tilapia eggs treated with 1,500 microgram/litre of androgen hormone were achieved at the maximum values of $91.25\pm 1.13\%$ (mean \pm SD) with the induced voltage of 375.50 VDC, HR of $91.70\pm 5.13\%$ and SR of $90.44\pm 3.15\%$, less than 10% egg death. The most suitable stages of egg development (day post fertilization: dpf) during zygote (1dpf)-cleavage-blastula-segmentation (2dpf)-pharyngula (3dpf) were carefully selected for electrical sex reversal but pharyngula was the optimized phase. This project can also be extended to kill TiLV virus and other bacteria on the egg's surface that cause Tilapia disease which are currently in urgent need.

A01:Biological (Poster) / 815

Effects of pulse-electric fields on tilapia's egg surfaces with rectangular and exponential decay waveforms

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In both electro-permeabilization and electrofusion, a high-intensity DC pulse electric field is employed to induced membrane breakdown and deliver macromolecules into living- targeted biological cells. The transient electric field is always applied in a pulsed form to prevent irreversible cell damage. The most commonly used waveforms are the rectangular pulse (square pulse, SP) and the exponential decay pulse (capacitor discharging, CD). The SP is usually generated by gating the output of a high-voltage power supply, while the CD is generated by discharging a capacitor that has been precharged at a high voltage. In the present study, the pulse width (time constant, τ) of the SP is characterized as a half of period of the waveform and is equivalent to the decay constant τ of the CD. The electric field of the latter case is an exponential function of time which τ is defined as the length of time at which the field strength is reduced to 0.368 times of the initial value. Electric field strengths of 50-100 kV/m generated for SP and CD with arbitrary mark-space ratio (pulse width: a half of period) were employed to observe the surface of Nile tilapia (*Oreochromis niloticus* L.) eggs in suspensions for electrical sex reversal propose. Pore densities and pore sizes appearing on the shell surface of the egg were measured from SEM micrographs. The local pores are minimum distance packed forming hexagonal patterns. The mean distance between pores is 1.65 ± 0.32 micron (mean \pm SD). They are volcano-shaped pores with a mean diameter (DP) of about 232 ± 25 nm and the pore

density per square micron (PD) is 0.73 ± 0.02 . Surprisingly, the eggs possesses a large single pore at the pole (the so called “polar pore”) which diameter is 11.1 ± 0.4 micron and is larger than the local pores. We found that 3-5 wave pulses, $50 \mu\text{s}$ of τ with 1:1 mark-space ratio were the optimized conditions for electro-permeabilization. Several deep, sharp pores and some partially open pores were easily observed through experiments. Pore densities of both cases of SP and CD were nearly equal (0.73). In the case of CD of five-square wave pulses, it was very interesting that the DP of CD was 764 ± 41 nm was larger than that of the SP experiments (686 ± 43 nm). Pore densities for the SP and CD were not significantly different.

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SYNTHESIS OF TiO₂ DOPED SELENIUM NANOPARTICLES USING HERBAL TURMERIC POWDERS COATING ON COTTON FABRIC FOR ANTIBACTERIAL

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Present work to investigation of structure and functional properties of nano materials based on the Titanium dioxide doping Selenium oxide and Turmeric coated cellulose fibers of gauze pad cotton. The Titania hydrosol was successfully prepared at low temperature by a microwave facilitated sol-gel method. The study also explored the efficiency of this sample to inhibit the growth of Escherichia coli and Staphylococcus aureus with various samples of Titanium dioxide, Titanium dioxide doped Selenium oxide and Titanium dioxide doped Selenium oxide with Turmeric powder. The morphology and composition of the surface pure and Titanium dioxide coated gauze pad cotton fibers were investigated by the SEM. The physical properties result showed the smaller size of Selenium oxide dope compound crystal (11.06 nm.) than undoped crystal (15.80 nm.) by the XRD test. The antibacterial activity against Escherichia coli and Staphylococcus aureus under ambient temperature showed that cotton coated with Titanium dioxide, Titanium dioxide doped Selenium oxide and Titanium dioxide doped Selenium oxide with Turmeric nanoparticles enhance bacterial inactivation efficiency completed 100% within AATCC Test Method*100-2004 standard.

A01:Biological (Poster) / 776

E. coli electroporation on tapered microfluidic system

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Electroporation is the technique used in creating pores on cell membrane by exposing the cell to high electric field strength. Microfluidic electroporation device takes advantages of miniaturized fluidic channel and electrode fabrication in obtaining high electric field strength using low applied voltage. In this work, the tapered microfluidic device for *E. coli* electroporation was developed based on printed circuit board technique. The tapered channel configuration with a closely spaced electrode

provide maximum electric field strength in an order of 10^5 V/m which results in enough transmembrane potential drop across the *E. coli* cell membrane. The COMSOL Multiphysics program with AC/DC module was used in simulating the transmembrane potential with the designed microfluidic device. The fabricated device was successfully in electroporating *E. coli* cell membrane when a 30 Vp-p 1000 Hz voltage is applied across 100 microns separated electrodes. The result of the study was confirmed by fluorescent imaging and SEM.

A01:Biological (Poster) / 698

Theoretical Investigation of Effects of Reynolds Number and Morphology on Localized Drag on Spheres, Spheroids, Rods and Segment of Helixes

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Diverse morphological shapes of cyanobacteria (blue green algae) have been observed in the natural environment; *Synechocystis* sp is found to be spherical, whereas *Arthrospira* is either a rod in a stationary phase or a helix in a logarithmic growth phase. Effects of Reynolds number and shapes on the localized drag exerted on solid objects with different geometrical shapes resembling the shapes of cyanobacteria including spheres, spheroids and segments of helixes are investigated by solving the Navier-Stokes equation using finite element method. Computed results indicate that, for the range of the Reynolds number of 0.001 - 10, the effect of Reynolds number on the localized drag on freely suspending spheres, spheroids and segments of helixes is small. If the effect of the inertia term is neglected, earlier calculations based on point force solution demonstrate that the localized hydrodynamic drag exerted on helixes is higher than the localized hydrodynamic drag exerted on long straight rods, indicating that morphology is a key factor determining the localized hydrodynamic shear drag on elongated bodies.

A01:Biological (Poster) / 581

Collapse of Cavitation Bubble Inside Microalgae

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One of the interesting methods used in disrupting microalgae is ultrasonication. In this study, the Keller-Miksis equation was used to simulate the dynamics of cavitation bubble inside microalgae cell species *C. gracilis*, *C. calcitrans* and *Nannochloropsis* sp. at frequencies of 1.0, 2.2, 3.3 and 4.3 MHz at the same acoustic intensity of 2.2 W/cm² and the physical effects of collapsed bubble to the microalgae cell were also investigated. The result showed that using the ultrasonic intensity at 2.2 W/cm² and the frequencies of 2.2, 3.2 and 4.3 MHz can produce the bubble to occur inside the microalgae cell. The impulsive pressure generated by the microjet from collapsed bubble inside the microalgae cell is high enough to break the microalgae cell wall since its value is found to be greater than Young's modulus of microalgae cell.

A01:Biological (Poster) / 438

A Molecular Dynamics Study to Predict Protonation Sites on the Xylanase Surface.

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Xylanase enzyme families play an important role in many industries due to its ability to digest the hemicellulose within plant cell walls. Developing the enzyme that can withstand extreme conditions under an industrial process and in a stomach requires an extended information in molecular scale for further protein engineering. In this study, atomistic molecular dynamics simulation and analysis was performed to assess the positive ion distribution patterns on the surface of a Xylanase enzyme molecule. The simulations were carried out at three different temperatures, representing room temperature (303K), optimum temperature (333K) and high temperature within an extruding machine (378K). Three sites with highest ion occupancy and temperature effects were identified. The results enable us to predict the most probable regions for amino acid protonation under acidic conditions at different temperatures.

A01:Biological (Poster) / 429

Why is the low-energy ion beam fluence to induce cell mutation orders higher than the cell lethal dose? – A puzzle

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Experimental facts have showed that in application of low-energy ion beam for biological living materials modification, the ion beam fluence required to induce cell mutation is orders higher than the cell lethal dose. This seems contradictory with common perception that the DNA modification should be proportional to radiation dose so that high dose radiation could cause high-degree damage in DNA to lead to cell death, while limited DNA damage produced by relatively low dose radiation would facilitate cell mutation. The author provides an answer to the puzzle from both physics and biology. Key points include the difference in physics between high-energy ionizing radiation and low-energy ion beam irradiation and the cell's non-linear behavior of responding to exogenous actions in biology.

A02:Physics Education (Poster) / 741

Pencil on paper as low cost alternative resistors

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Pencil leads can be used to draw resistors, which are low-cost and easy to obtain. Not all types of pencils are considered good for pencil resistors because pencil lead is made up of graphite, an allotrope of carbon. Resistance of graphite varies with the grades used during manufacturing, as such we aimed to review and test several types of pencils would be best for developing DC pencil circuits. The resistance of pencil traces was found to depend on pencil grade used in drawing, width, and thickness or numbers of layers. The 6B grade was found to be the best pencil for drawing resistors. The applied pressure and bending paper inward and

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A Comparison of Gravitational Acceleration Measurement Methods for Undergraduate Experiment

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This research aimed to determine the acceleration due to gravity: g , by using a free fall, a simple pendulum, a physical pendulum and the Atwood's machine methods from an undergraduate laboratory. The experiments were designed for the student to think, analyze the data and interpret the results of an instrument using the principle of physics laboratory. In this study, the mean experimental values of acceleration due to the gravity were $9.64 \pm 0.23 \text{ m/s}^2$, $9.67 \pm 0.12 \text{ m/s}^2$, $10.88 \pm 0.96 \text{ m/s}^2$ and $10.47 \pm 1.780 \text{ m/s}^2$, respectively.

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Students' Alternative conception in Vector Addition and Subtraction

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In this article, we explored students' alternative conception from specific worksheet responses. The implemented worksheet from previous research study was designed to enhance students' conceptual understanding of vector addition and subtraction. After administered the worksheet to 5 classes of 157 grade eight students in a general science course at a large public Bangkok school, we found students' alternative conception from their responses. 1) Vector symbol; 8% of the students wrote only capital alphabets and 4% of them wrote incorrect vector symbols as they put an arrow on side of capital alphabets in the same direction as the given vectors. 2) Vector addition in two dimensions; 34% of them drew added vectors in wrong magnitude because they put the first given vector in the middle of grid lines. Other students (13%) added vectors by keeping distance between the added vectors as the original vectors given in the worksheet. 3) Opposite direction vector; 24% of the students drew vectors in opposite direction but not exactly the same. To deduct the students' errors, physics instructors should carefully emphasize vector symbol, remind students to put vectors in a line of grids, and explain more about opposite direction vector.

Keywords: Vector, Vector addition; Vector subtraction; Worksheet

A02:Physics Education (Poster) / 590**Survey of Understanding conceptual about the Red Moon during Lunar Eclipse of the first year undergrad student, school of science, University of Phayao, academic year 2017****Author:** Patchamon Woonoon¹**Co-author:** Watcharawuth Krittinatham ²¹ *School of Science, University of Phayao*² *School of Science, University of Phayao***Corresponding Author:** patchamon56@gmail.com

We investigate the first-year undergraduate students' understanding concepts about the color of the Moon during Lunar Eclipse. The sample is 68 students from Physics, Chemistry and Biology major, school of science, University of Phayao. We use the 2 open-ended questions about the color of the moon and Lunar eclipse. The students' answers are analyzed from their drawing diagrams and/or text representation. The results show that we can group the students into 3 groups i.e. (1) understanding (34%), (2) partial understanding (25%), and the rest (3) not understand or misconception.

A02:Physics Education (Poster) / 614**Students' SCIENTIFIC MODELS OF Momentum****Authors:** Rujira Sinchai¹ ; Umporn Wutchana^{None}¹ *Thailand Center of Excellence in Physics , Commission on Higher Education***Corresponding Author:** nhing_rujira@hotmail.com

A class of 17 grade ten students of The Demonstration School of Ramkhamhaeng University (Secondary Level) had been taught by modeling-centered instruction sequence (MCIS) on the topic of momentum for 2 hours. The students participated in nine learning steps of MCIS; (1) anchoring phenomena and central question, (2) construct an initial model, (3) empirical investigations, (4) evaluate and revise the initial model, (5) introduce scientific ideal and simulations, (6) evaluate and revise the model, (7) peer evaluation, (8) construct a consensus model, and (9) use the model to predict or explain. Then, we focused on evaluating their ability to create scientific model during the steps 6, 7, 8, and 9. The students' ability to create scientific model was analyzed by separate evaluation criteria (Analytic Rubrics).

A02:Physics Education (Poster) / 616**Optimized conditions of Schlieren photography****Authors:** Dondanai Bunjong¹ ; Nirut Pussadee² ; Pornrat Wattanakasiwich³¹ *Department of Physics and Materials Science, Chiang Mai University, Chiang Mai, 50000, Thailand*² *Plasma and Beam Physics Research Facility, Department of Physics and Materials Science, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand*³ *Department of Physics and Materials, Faculty of Science, Chiang Mai University, Chiang Mai 50200; Thailand Center of Excellence in Physics, Commission on Higher Education, 328 Si Ayutthaya Road, Bangkok 10400, Thailand*

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Schlieren photography is a technique used to capture air movement based on difference in fluid density. Air with higher temperature has lower density than surrounding air with lower temperature, leading to different values of refractive index. This work aimed to determine optimized conditions for schlieren photography to capture air movements in several situations. Schlieren photography was set up by using an off-axis single mirror and lens-and-grid system. The parabolic mirror with a 14.1-cm diameter has a focal length of 131.2 cm. The air movement was captured with Nikon V1 at 400 frames per second with resolution of 640x240 pixels. The camera was set at ISO400 with f/5.6 and used with 70 – 300 mm zoom lens. Optimized conditions include percentage of light blocked by a knife edge, distance of test area to the mirror, illuminance of light source, and ambient temperature.

A02:Physics Education (Poster) / 617

Analysis of Students' Conceptions in Vectors with Mechanics Context

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A group of physicists from Mexico developed a standard test in vector conceptions without any physics related context called “Test of Understanding of Vectors (TUV)”. This test was first conducted as open-ended questions which later on was re-designed as a 20-item multiple-choice test. Since physics is a subject that involves quantities like vectors, and students’ understanding of concepts in vector may cause difficulty in solving problems. In this study, we first modified the TUV by adding the physics context – Mechanics – in the test. Then 136 undergraduate students registered in the General Physics 1 class at Chulalongkorn University in 2017 were tested using our modified-TUV and original-TUV tests prior learning the vector concept in the first week of their class. The results have been evaluated using the item analysis, and the efficiency and reliability are compared between those tests. We found that there are similar tendencies of statistical indices for both tests, which are within the acceptable values. Thus our modified-TUV test is reliable to test students’ conceptions in vectors with mechanics context.

We have also emphasized on the dot products in both TUV tests. The results show that students have more difficulty in understanding the definition of dot products than they do in the dot product operations. Furthermore, they did better in modified-TUV with physics context than original-TUV with only mathematics context.

A02:Physics Education (Poster) / 654

A low-cost Arduino microcontroller for measuring magnetic fields in a solenoid

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This work aims to introduce a low-cost experimental set up using an Arduino board for studying the magnetic induction concept. We use a Hall Effect sensor to detect the magnetic fields inside a long

solenoid applied the DC current. The results revealed that for the DC current varied from 20-160 mA, the Arduino sensor processed the magnetic fields in a range of 0.77 - 5.27 mT. Collected data between the currents and the magnetic fields were straight plotted with $R^2 = 0.99$. We applied the Ampere's law to estimate the amount of the wire loops used as 1,016 rounds, with 2% error. This apparatus is inexpensive, easy to build and obviously demonstrates physics variables on the Arduino board. The experiment, along with the discussion of the electricity and magnetism, will be of benefit to students in physics class.

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Photogate sensor for compound physical pendulum experiments

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Instructional instruments play an important role in support students' learning through the active learning approach. This research proposes a compound physical pendulum experiment using a photogate sensor. The sensor was set up to determine the frequency of an object vibrating back and forth using the application of an Arduino board. The designed sensor can measure the frequency in a range of 0.001-1000 Hz, which can be simply used for demonstration the harmonic motion in physics laboratories. Here, the compound physical pendulum used consists of a disk of radius 4.80 cm and mass 420.00 g, fixed at the end of a rod of mass 125.00 g and length 53.00 cm. The experimental result shows a strong agreement with the theoretical calculation of the physical pendulum equation with only 2% difference. The low-cost photogate sensor made of an Arduino microcontroller can be one beneficial option for physics small to large classrooms.

A02:Physics Education (Poster) / 690

Virtual X-Ray Diffractometer using acoustic wave for material science education

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In this research, virtual X-Ray diffractometer (XRD) using acoustic wave for material science education has been proposed. Acoustic wave with frequency in ultrasonic range has been used to characterize acoustic crystal structures. The dimensions of these model structures, which are in order of ultrasonic wavelength region, have been formed by three dimensional printer (3D printer) and cotton swab. The angle of ultrasonic source and detector have been swept to record reflected wave signal of each angle. The peak of each angle have been selected to calculate lattice spacing by Bragg's law and then compared with the implemented structure. The results show signal peaks of each diffracted angle and each structure model. The experimental results showed that the lattice spacing values obtained from acoustic experiment were in good agreement with the measured values of the implemented structures. This virtual XRD system provide to be an efficient tool for understanding about crystal structure characterization.

A02:Physics Education (Poster) / 715**Uncertainty Analysis of Linear Least Square Fitting Apply to Non-linear Model****Author:** Thanaporn Arunthong¹**Co-authors:** Suwinus Thuenuhan¹ ; Pannate Wongsripan¹ ; Sakchai Chomkokard¹ ; Wiwat Wongkokua¹ ; Noparit Jinuntuya¹¹ *Kasetsart University***Corresponding Author:** b5710402176@ku.ac.th

Linear least square is a common method to fit two dimensional data set with linear relation. In non-linear case we need to do some linearization before fitting. Parameters can be extracted from the fitted line and used to predict new dependent variable values at new independent variable points. In this report we investigate the uncertainty introduced to a non-linear model prediction from linear least square fitting. As an example, we fit a data set with the model $y = a/x$, which is the physical model of measurement we are interested. The fitting goes well and we get the curve with R-square very closed to one. However, when we use the fitted parameters to actual measurements, the accuracy are poor, especially at large y . At first we expect that this due to the functional form of the model. When compare with high order polynomial fitting we realize that this is not the case, since, for example, the fifth-degree polynomial gives less than one percent error, about 10 times less than linear fitting prediction. It is because the linearization and the inverse transformation to the original space in the linear least square method that give rise to the uncertainty. Our analysis can be generalized to any non-linear model prediction. We expect our results to be a caution to anyone using linear fitting to their non-linear model prediction.

A02:Physics Education (Poster) / 720**Measuring sound speed in the air with Phiang Aw flute****Author:** Naruepon Weerawongphrom¹¹ *Mahidol Wittayanusorn School***Corresponding Author:** n.weerawongphrom@gmail.com

Sound speed in the air can be measured from resonance phenomena in an open-open tube. In a typical undergraduate laboratory, sound is generated with a specific frequency, and lengths associated with resonance are recorded. Subsequently, those data can be used to determine the sound speed. Instead of using a specialized apparatus, this work demonstrates a method to measure sound speed using Phiang Aw flute and sound spectrum analyzer application on mobile phone. Phiang Aw flute is modeled as an open-open tube: one end is the mouth hole, and the other end is the finger hole. Length of the open-open tube is varied by opening different finger holes. Consequently, the frequencies that resonate with the tube change depending on its length. Resonant frequencies can be found from a sound spectrum analyzer, which typically use Fast Fourier Transform algorithm. Data on tube lengths and associated frequencies are used to determined the sound speed by linear regression. In addition, end correction length is automatically found. The difference between sound speed from this experiment and the adiabatic sound speed can be less than 5%. Therefore, this experiment can be used as a hands-on demonstration in introductory physics classes. Finally, because of its low cost, this experiment can be implemented on virtually every school in Thailand.

A02:Physics Education (Poster) / 787

The Development of Metacognitive Control through the Metacognitive Development Process in Science Classroom

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The development of metacognitive control in science classroom is the process of this study to review themselves. This study aimed to investigate the metacognitive control of 10 students through the use of the Metacognitive Development Process (MDP) that has the following overall objectives: 1) to develop students' metacognitive control for free content of science class 2) to develop students' metacognitive control in the simple circuit content with simulation and 3) to develop students' metacognitive control for the projectile motion content with simulation. This study was a mixed-action study conducted within quantitative and qualitative data analysis. The main findings of this study reveal that the most student of the first phase as never on planning, monitoring and evaluating. When that used of the Metacognitive Development Process (MDP) were students' metacognitive control on planning, monitoring and evaluating are seldom. The results of this study suggest that all of the phase of study was the most student can understand and know their own thinking and acting. They showed improved understanding and awareness about how to improve their planning, monitoring, and evaluating in science classrooms.

A02:Physics Education (Poster) / 807

Students' learning in Physics Laboratory

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Abstract

The aim of this study was to explore the students' learning in Physics Laboratory with 103 undergraduate students in Yala Rajabhat University at Southern of Thailand. The data were collected by ASELL survey to investigate students experience in the Lab, open-ended questions to investigate students' ability to do experiments and semi-interview of 10 students to investigate students' attitude in learning physics laboratory. The data from ASELL survey was analysed by basic statistic, and the data from open-ended questions and interview were analysed by interpretation method. Results from ASELL survey showed students' attitude towards physics lab that they did not strongly agree with the physics lab are; developing data interpretation and laboratory skills, interesting, clear assessment, clear learning objectives, increasing understanding of Physics, sufficient background, effective laboratory instructors, good laboratory manual, relevance to Physics studies, developing teamwork, responsibility for own learning and overall learning experience. The open-ended questions were used to confirm the data from ASELL survey and found that most students explain experiments in the lab unclear. Some of them cannot explain and have no idea about what they did in the lab. These showed that learning in physics laboratory did not efficiencies. In addition, from the interviews showed that they need reflection from teacher about the experimental result in the end of the lab and they need to share their experiment results to classmate.

Keyword: Students' learning, Physics Laboratory, ASELL survey

A02:Physics Education (Poster) / 808

The misconceptions in learning celestial sphere of students, science teacher students and science teachers.

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Teaching and learning astronomy is not effectively in class event in the University level. Because the concept of astronomy is abstract and complicate for students. Many of student teachers have difficulty of how to create their lesson to help students learn astronomy. Because of they are not confident in concepts of astronomy. Especially in the concept of celestial sphere, the concept is very complicate event teacher use their tools in class such as model and simulation to help student to learn. In learning celestial sphere, students have to use their 3D imagine to understand the concept. Therefore this study need to know how people learn celestial sphere concept by investigate their misconception by using the open-ended questions in many ways. The article summarized misconceptions in learning celestial sphere of Thai students, science teacher students and science teachers. The participate were 30 students in grad 11 of Khoksiwittayasan school in Sakhonnakhorn, 30 science education students in the 4th year of Khon Kaen University and 10 science teachers around North-East of Thailand. All of the participants had the experiment in learning celestial before doing the open-ended questions. The results found that students, teacher students and teachers had misconceptions in learning celestial sphere in many concepts such as 1) the maximum altitude of star was equal the altitude of Polaris 2) the stars rise up at the north-east and set down at the south-west when observe at latitude 10 degree north.

A02:Physics Education (Poster) / 450

Using the Arduino with LabVIEW on Moment of Inertia experiment

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This paper shows the physical nature of moment of inertia. The classical experiment is done using the pulley, string, a mass holder and a set of masses. The modern experiment is based on computer controlled with LabVIEW to interface with Arduino Uno R3. The DIY photogate is made of 30mA@5V laser and light diode resistance (LDR) that two different intensity of light are used as two logical states (low and high) to measure time interval. An acrylic support is placed on a 12V high torque DC motor. The speed of the motor is controlled by a potentiometer. This experiment is designed to use the objects are aluminum sheet and cylindrical steel pipe. We found that the moment of inertia of aluminium sheet and cylindrical steel pipe (central axis) are 0.000434 and 0.000085 kg·m². The difference between the theoretical and experimental is 12.50 % and 13.26 %, respectively.

A02:Physics Education (Poster) / 451

The Speed of Sound in Air of Pipe Acoustic Resonance via the Arduino with LabVIEW Interface

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The purpose of this study was to develop a modern experiment apparatus using Arduino with LabVIEW to instead of the classical experiment. The sound frequency is generated from application on smart phone. The sound intensity and ultrasonic sensors are used to measure the sound intensity and displacement which is connected to the Arduino with LabVIEW. The resonance frequency for each harmonic series in pipe (closed at one end) is shown on the computer. The speed of sound in air is determined and the result show is in a good agreement between theory and experiment.

A02:Physics Education (Poster) / 467

Low-Cost DIY Anemometer based on LabVIEW interface for Arduino**Author:** Meechai Thepnurat¹**Co-authors:** anusorn tong-on² ; Parinya Saphet²¹ Chiang Rai Rajabhat University² CRRU**Corresponding Author:**

An anemometer was fabricated from a low-cost material in a DIY (Do it yourself) process. It was composed of the rotating vane (it was modified from cooler CPU) which was installed with speed sensor on it. Then, it was connected with Arduino board and controlled by LabVIEW program. This anemometer was called Anemometer based on LabVIEW interface for Arduino (ALA) model. Then, an ALA was calibration compared with a hand-held standard anemometer (TECPEL model of AVM-702) of the velocity measurement of wind (V_w) 0.6-4.7 m/s from the wind source. It was found that an ALA had the discrepancy about 9.72 %. An ALA has low cost and was easily DIY fabricated for application in Physics Education Lab at a high school in future.

A02:Physics Education (Poster) / 529

A study of matter-wave diffraction for particle in the near field regime under the influence of a uniform electric field**Author:** Chaimongkol Artyotha¹**Co-authors:** Boonlit Krunavakarn¹ ; Nupan Kheaomaingam¹ ; Sarayut Deachapunya¹ ; Sorakrai Srisuphaphon¹¹ Department of Physics, Faculty of Science, Burapha University, ChonBuri Province, 20131, Thailand**Corresponding Author:** chaimongkol_f@hotmail.com

For various experiments to investigate quantum effects, matter-wave diffraction is an apparent example. Particle diffractions have been measured even at the large molecular level, such as the C_{60} molecules. In order to describe the matter-wave diffraction of C_{60} beam, we assume the initial wave functions behind a grating in form of the Fourier series with a Gaussian distribution function. By applying the Feynmann path integral, the exact wave functions of the molecule diffraction in the near-field regime can be derived analytically. The obtained probability density distributions are corresponding to interference fringes as found in the Fresnel diffraction. The probability of finding C_{60} molecules, behind the grating at the Talbot length, consistency with the mentioned experimental data of C_{60} diffractions.

A02:Physics Education (Poster) / 547**A STEM Education Activity in Physics on “Designing and Making Khom Loy (Small Thai Traditional Hot-Air Balloons)”**

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This study aimed to develop STEM Education activities in Physics on designing and making Khom Loy (small Thai traditional hot-air balloons.) The local in the north of Thailand use Khom Loy to celebrate important events such as Loy Krathong Day. The samples of this study were 35 students from 2 groups from high-school level and undergraduate level. The research instruments were 1.) a test of the abilities to integrate knowledge in Physics and Mathematics to explain the movement of balloons, and 2) 2 sets of questionnaire on attitudes towards Physics and on learner satisfaction. The results of the activities were 7 steps as follows: 1) informing the tasks of the activities and informing students how to evaluate the learning outcomes 2) letting students make Khom Loy based on their own experience 3) training students on the motion of Khom Loy based on Physics and Mathematics 4) analyzing factors related to designing the Khom Loy and writing a diagram reflecting the relationships among the factors 5) analyzing the designs of Khom Loy in possible ways and choosing the best to make it 6) designing Khom Loy in papers, and 7) making actual Khom Loy based on the design in papers and test the performance of Khom Loy. The results of using the STEM activities revealed that the abilities to integrate knowledge in Physics and Mathematics after using STEM education activity were significantly higher than before applying STEM activity at .05. In addition, the satisfaction of STEM activity was at high level.

A03: Optics and Photonics (Poster) / 474**HIGH-FREQUENCY SIMULATION OF ACOUSTIC LENSES BASED ON FRESNEL ZONE PLATE**

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In this work, we develop a Fortran program to simulate the propagation of high-frequency plane acoustic wave through Fresnel zone plate (FZP) in two dimensions. The simulation was carried out at the frequency of 200 kHz with the wave speed of 1,500 m/s. The thickness of FZP was also varied to determine its effect on the focusing of FZP. Numerical results show that FZP could successfully focus the acoustic wave. The results also matched well with the simulation result of a previously published work of underwater acoustics. An efficiency comparison between FZP and a scattering-type acoustic lens focusing a wave at the frequency of 2140 Hz and wave speed of 330 m/s was also reported.

A03: Optics and Photonics (Poster) / 693**Strain Distribution in Circular Disk of PMMA by Using Reflection Polariscopes**

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The experiment was conducted to study strain distribution in circular disk of PMMA by photoelasticity in reflection polariscope. The strain in circular disk was induced by two point load of hydraulic system 535.37-994.63 N with the step increase of 153.21 N. We added the Babinet compensator in basic reflection polariscope to observe the fractional isochromatic fringe order in the first quadrant of disk and we calculated strain by using stress-strain optic laws. The result showed the relation between absolute of different strain in first quadrant of circular disk and the relation of force with absolute of different strain. It was found that maximum different strain produced at contact area of disk decreased along horizontal and vertical direction. The relation of force with different strain was linear.

A03: Optics and Photonics (Poster) / 717

Comparison Qubit Errors Rates of Weak Coherent Pulse Laser and SPDC Sources for BB84 Protocol in One-meter Free Space

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Quantum key distribution (QKD) concerns creation and distribution of unbreakable symmetric one-time keys which are used in classical message encryption and decryption. Using quantum properties, the QKD security is enhanced by observation of qubit errors rates (QBER). Although the quantum principles, such as no-cloning theorem, imply that QKD has strong safety, the imperfect devices can yield weak points for eavesdropping attacks. Thus, the evaluation of QBER during contact is important to ensure that QKD is secured. We aim to evaluate and compare QBER of the QKD BB84 protocol process between different photon source models; namely, the model using a weak coherent laser pulse which is attenuated to obtain the average photon number per pulse (μ) equal to 0.05, and the model using the spontaneous parametric down conversion (SPDC) photon source, which has 2000 photon pairs per second in one-meter free space. We devise an experimental setup to measure QBER in both models, where the linear optical devices are used and calibrated to obtain appropriate operators acting on quantum states. Additionally, we build an electronic circuit using Arduino to generate 2360 Hz laser pulse and collect raw keys to calculate the QBER. The experimental results will be discussed.

A03: Optics and Photonics (Poster) / 683

Cross-Polarized Wave Generation in a Nonlinear Hyperbolic Metamaterial

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A generation of cross-polarized wave (XPW) in nonlinear hyperbolic metamaterials (NHMM), which are composed of periodic arrangement of gold (Au) and barium difluoride (BaF₂) layers with sub-wavelength thickness for exhibiting anisotropy of permittivity and third-order nonlinearity, has been investigated numerically. This cubic nonlinear effect is described by degenerate four-wave mixing (DFWM) of three linearly polarized fields and one produced field, which has linear polarization in orthogonal direction. By managing the fill-factor value of the NHMM, the nearly phase-matched condition based on quasi-birefringent phase-matching (QBPM) technique are achieved implicitly. We found that the conversion efficiencies of XPW generation as a function of incident angle at various pumping intensities are maximized at optimal incident angle.

A03: Optics and Photonics (Poster) / 615

Age estimation of blood stains by reflectance spectroscopy

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Blood stains at crime scenes are among the most important types of evidence for forensic investigators. We can use bloodstains to determine the time elapsed since the crime took place by measuring the color changing of blood stain with reflectance spectroscopy. The color of blood stain changes with time from red to brown due to the change of chemical composition in hemoglobin that is transition of oxy-hemoglobin into met-hemoglobin and hemichrome. In this study, we determine the fractions of oxy-hemoglobin, met-hemoglobin and hemichrome at various time in period of 0-25 days under the control of temperature and humidity. The results show that determining the fractions of three hemoglobin derivatives can not be used to estimate age of blood stains more than 14 days because after 14 days, the color of blood stains remain unchanged.

A03: Optics and Photonics (Poster) / 659

A comparative study of Perylene derivatives in organic bulk heterojunction solar cells

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Perylene derivative were used as electron acceptor in non-fullerene organic solar cells using the structure of ITO/PEDOT:PSS/PCDTBT:Acceptor/TiO_x/Al. Unfortunately, PCDTBT:Perylenediimide photoactive device showed a low power conservation efficiency (PCE), compared to a PCDTBT:PC₇₀BM

photoactive device. This results has been observed in reduced short circuit current (I_{sc}) and open circuit voltage (V_{oc}). The devices with electron acceptors as Perylene diimide-1 and Perylene diimide-2 showed excellent efficiency of 0.27% and 0.26%, respectively, with weight ratio of PCDTBT:acceptor (1:2). In addition, the morphological and optical properties of PCDTBT:acceptor thin films were investigated. The high roughness and low absorbance due to the perylene network were consistent with the low efficiency of solar cells.

A03: Optics and Photonics (Poster) / 631

Off-null ellipsometer based on smartphone platform

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In this research we have designed and constructed the first off-null ellipsometer based on smartphone platform. The principle design of this ellipsometer is configured to use a smartphone screen as a light source and front phone camera as a detector. Thus the configuration of the optical coupler is necessary to collect a parallel beam of linearly polarized light from a phone screen and direct it to sample surface. The reflected light from the sample surface passes through the analyzer and the coupler projects the ellipsometric image to the front camera of the phone. So that it is necessary to develop the mobile phone application, which can display images on phone screen as the light source and take the picture of the measurements simultaneously. The obtained images are analyzed by calculating the average intensity in the red color channels of the front camera for a predefined region of interest. Moreover, microfluidic channels, adhered on the top of chip sensor (Optislide), is used for the flowing of liquid sample to study the adsorption of solution on liquid/solid interface based on the change of the polarization state of the reflected light. Calibrations are carried out with ethanol solutions of four mass concentrations of 0, 10, 20 and 30%. As a result, the off-null ellipsometric intensity, which is analyzed from pictures, and the mass concentration values are linearly dependent. From this work, the smartphone-based off-null ellipsometer combined with microfluidic channel allows investigating several fluid compositions on liquid/solid interface in parallel.

A03: Optics and Photonics (Poster) / 625

Study on light absorption of crude palm oils by using different light sources

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Modern analysis of organic materials by using light absorptions are very popular both in industries and research laboratories. Typically, UV-VIS spectrophotometer are used. UV-VIS consist of broad spectrum gas light source and UV source, monochromator and light detectors. The UV-VIS is very complicated and expensive. In this research we would like to develop simple and cheap spectrophotometer for specific absorption of wavelengths. The LEDs which emitting Gaussian shape spectrum are used as light sources and light detectors. Absorptions of wavelengths 269 and 446 nm by crude

palm oils were studied. The results for UV-VIS and LED spectrophotometers will be compared. Since the Full Width at Half Maximum (FWHM) of the two light sources are different, the dependence of absorption on temperature and palm oil density will be discussed.

A03: Optics and Photonics (Poster) / 597

3D Information Retrieving of Concealing Surface beneath Opaque Resin Layer by Fast-Fourier Low Coherence Interferometer

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A normalized contrast method on a Superluminescent diode (SLD) low coherence interferometer could retrieve 2D image concealing under a light-scattering medium. In addition, a continuous wavelet transform on both white light and SLD vertical scanning interferometry could construct 3D profile of the interfaces in a dual-layer structure. In this research, 3D information on surface, concealing beneath opaque resin layer, will be produced by using SLD phase difference interferometry with a Fast Fourier Transform. The effect of opaqueness of coating resin layer to quality of 3D image from our method will be revealed.

A04: Plasma and Nuclear Fusion (Poster) / 578

Plasma Diagnostics by Multipole Resonance Probe

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Multipole Resonance Probe (MRP) can be used to determine plasma parameters including plasma density. This project is divided into 2 parts. The first involves simulation of dissipation power by using MATLAB analytical program. The second part is the construction of MRP. The locally made probe is used to characterize DC plasma at the electrical input power of 0, 24, 31.35, 60 and 91.74 watts and a pressure of 0.6 millibars. The distance between the plasma source electrodes is 7 centimeters. The tested probe is connected with a Network Analyzer. The peak of a plot between dissipation power versus frequency can be analyzed to yield the plasma density. It has been found that our simulation process yield the highest dissipated energy transfer frequency that agree well with the anticipated result from the model. The multipole probe results of our DC plasma source indicate increasing plasma density with increasing electrical power.

A04: Plasma and Nuclear Fusion (Poster) / 612

Enhancing of electric field strength by electrode geometries and dielectric materials for surface discharges in ozonizer

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Ozone is a very strong oxidizing agent, widely used in industrial, environmental and agricultural applications. Ozone generated by ozonizer, when air or oxygen ionized to form plasmas under high-frequency and high-intensity electric field. The intensity of electric fields depend on electrode geometry, gap size, applied voltage and dielectric materials. In this study, effects of electrode geometry and dielectric materials on electric field intensity and distribution were calculated by theoretical analysis and COMSOL multiphysics software. The results that show the highest electric field intensity will be used for the design of the ozonizer in the future work

A04: Plasma and Nuclear Fusion (Poster) / 627

Enhancement of Nitrite and Nitrate in Tap Water by Cold Atmospheric Plasma

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Nowadays, Fertilizer is very necessary in agriculture cause of soil problem. It has many ways to produce and Cold Atmospheric Plasmas is the one way which has been examined earnestly for along time. It can generate many energetic species of ionized gas in ambient air, especially they can produce reactive nitrogen species (Nitrite NO_2^- , Nitrate NO_3^-) [2-3] which they are essential elements required for prosperous plant growth and biological process including transportation, excretion and absorption [1, 4]. In this experiment, Cold Atmospheric Plasmas that can enhance quantity of nitrite, nitrate in tap water by using the floating electrode, made from tungsten rod and inserted into the Pyrex glass tube and power source is produced by RF power supply of 7 – 9 kV and 50 – 800 kHz. The Air discharge plasmas, generated above the tap water surface for an hour, enhance quantity of nitrogen species for producing green fertilizer without chemicals and residue.

A04: Plasma and Nuclear Fusion (Poster) / 666

The Comparative Studies of Gamma-ray Shielding Properties of the PbO-BaO-B₂O₃ Glass System by Using FLUKA Code to XCOM Program and Accessible Experimental Data.

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We had performed computer simulations by using FLUKA code for investigating the gamma-ray shielding properties of the $x\text{PbO}-(50-x)\text{BaO}-50\text{B}_2\text{O}_3$ glass system (where $5 \leq x \leq 45$ mol%) for the 356, 662, 1173, and 1330 keV photons (gamma-ray) energies. Then we compared the results to the XCOM program and the experimental data. We found, the results agree very well with the XCOM and the real data. Furthermore, we also found that the results from FLUKA slightly closer to the experimental data than the XCOM.

A04: Plasma and Nuclear Fusion (Poster) / 675**Study of air plasma jet on *S. aureus* inactivation****Author:** waraporn sisworakunchai¹**Co-authors:** Dheerawan Boonyawan² ; Sureeporn Sarapirom ; Chakkrapong Kuensaen ; Pipath Poramapijit-wat¹ _² Chiang Mai University**Corresponding Author:** waraporn_siri@cmu.ac.th

Nowadays, plasma technology has an important role in medical treatment. It is used to help Diabetes Miletus patients with chronic wounds and patients with bedsores to get more effective treatment. It is also used as bactericidal method. This research studied an air plasma jet with the efficiency in inhibitory of *Staphylococcus aureus*. The study aimed to study the effect of number of pulse and treatment time of *S. aureus* inactivation. The numbers of pulse used are 2 4 6 8 10 μ s and Time of treatment (s) used are 10 30 60 120 300 s. The results showed the effectiveness in killing bacteria. Hundreds of percent of the working area (the same size of the area of the plasma head) was found to increase as the number of pulse is increased. When adding time of treatment, disinfection is more effective.

A04: Plasma and Nuclear Fusion (Poster) / 682**The Comparative Study of the Radiation Shielding of (60-x) PbO-x Li₂O-40 B₂O₃ (where $0 \leq x \leq 25$ mol%) Glass System by Using FLUKA to XCOM and the Previous Experimental Data****Author:** Chahkrit Sriwunkum¹**Co-authors:** Tanin Nutaro¹ ; Alejandro Saiz²¹ Ubon Ratchathani University² Mahidol University**Corresponding Author:** chahkrit.sr.60@ubu.ac.th

We had investigated the efficacy of FLUKA Monte Carlo (MC) code for the gamma radiation shielding parameter calculation of the (60-x) PbO-x Li₂O-40 B₂O₃ (where $0 \leq x \leq 25$ mol%) glass system. The mass attenuation coefficients (μ_m), the effective atomic number (Z_{eff}), the effective electron density (N_{el}), mean free path (MFP) and half value layer (HVL) were investigated in the various sample of glasses for photon beams at different energies, 356, 662, 1173, and 1332 keV. Then we compared the results to the standard XCOM and the previous real experimental data. We found that the calculated values agree well with measured values from recently published experimental work, for which the maximum relative deviation is less than 1.5 % for all the glass samples.

A04: Plasma and Nuclear Fusion (Poster) / 684**Construction and Characterization of Electron Cyclotron Resonance Oxygen Plasma for Tourmaline Treatment****Author:** Chaipipat Pangkasorn¹**Co-authors:** Dheerawan Boonyawan¹ ; Saweat Intarasiri¹ ; Duangkhae Bootkul² ; Udomrat Tippawan¹

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Generally, Plasma consists of ions, electrons and neutrals. Neutrals are the product produced much higher than other two products, but only ions and electrons are used for surface material modification. Electron cyclotron resonance is one of the techniques to apply external magnetic field in order to increase ions and electrons of produced plasma. This work aim to study influence of external magnetic field to a number of produced ions and electrons from a new construction of Electron Cyclotron Resonance for oxygen plasma. The assumption of increased ions and electrons density affect to advantage of plasma solid interaction, which is used for tourmaline treatment application. Plasma irradiation characterization will be used to investigate optical emission spectrum.

A04: Plasma and Nuclear Fusion (Poster) / 707

Electrical Characteristic and Radicals Determination of Air Plasma Jet

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Currently, production of an air plasma jet is the remarkable innovation that converts air to heal infected wounds. The aim of this research is characterizing air plasma jet in burst mode. Plasma power is varied by pulse delay from 5 to 40 μ s at fixed pulse width and the number of pulse from 2 to 10 pulses at fixed burst mode frequency. Then, plasma radicals are determined using Optical Emission Spectroscopy (OES) by pulse delay variation from 5 to 40 μ s, number of pulse variation from 2 to 10 pulses, and air velocity of 2 to 6.5 SLM. The results show that air plasma jet produces suitable radicals for biomedical applications, including nitric oxide and ROS radicals such as hydroxyl radicals (OH), oxide radicals (O), and ozone (O₃). The plasma power can be controlled by pulse delay and number of pulse.

Keyword: Air plasma jet, Electrical characteristic, Radicals determination

A04: Plasma and Nuclear Fusion (Poster) / 772

FTIR analysis of Thermal and Plasma Treatments on Riceberry Brown Rice

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Riceberry brown rice is known for its valuable nutrients with texture similar to white rice. Recently our group has used plasma treatment on riceberry brown rice to effectively shorten their cooking time and soften their texture. During plasma treatment, rices were also subject to elevated temperature. This sometime has lead to confusion whether the thermal effect dominate. In this study we have carried on these issues by using Fourier Transform Infrared spectroscopy (FTIR) to follow changes in vibrational characteristics of riceberry brown rice the plasma treatment. The treatments were performed using inductively coupling plasma and low-pressure argon with 13.56-MHz RF-generator at 100 W for about one second. This is done in comparison to conventional thermal treatment at 45°, 60°, and 75°C for 120 minutes. Stark contrast changes have been observed from FTIR spectra. Firstly, in the region of 2500 – 3000 cm⁻¹ the O-H stretching group was found to increase in the plasma treated samples; while decreasing in all the other thermal treated samples. The decrement has varied monotonically with temperature. Secondly, there is also significant increasing of C-O-C skeletal mode of a-glycosidic linkage and C-O-H bonding and C-O-C asymmetric stretching glycosidic bonds in the plasma treated samples; while the decrement were observed in the thermal treatment. This is understood as a consequence of cross-linking effect; leading to increasing in glycosidic bonds along with H₂O abstraction during plasma treatment. It can be concluded that plasma treatment has caused more inclusive effects which never be achieved by the lone thermal treatment.

A04: Plasma and Nuclear Fusion (Poster) / 799**Surface modification of Poly (ethylene terephthalate) fabric by plasma process**

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Surface properties of Poly (ethylene terephthalate) or PET fabric were modified by nitrogen plasma pretreatment, chitosan pretreatment and combined of nitrogen plasma - chitosan pretreatment, to improve ink absorption of water-based pigmented inkjet ink. The samples were exposed to the plasma at the operating pressure of 0.8 mbar. The operating RF powers were varied from 50-100 W. The treatment times were set in the range of 0.5-10 min. and the concentration of Chitosan in hydrochloric acid solution was set at 3 g/L. Scanning Electron Microscopy was used to observe the morphology of PET. The protrusions and grooves increase with increasing RF power and treatment time. Analysis of functional groups by Fourier Transform Infrared Spectrometer showed transmission peak at 2969.30 and 1731.42 cm⁻¹ which represent a C-H and a Carbonyl (C=O) stretching, respectively. Color strength values (K/S) were evaluated by UV/VIS/NIR spectrometer; spectrum refraction was used to calculate from Kubelka-Munk theory. The K/S values of nitrogen plasma pretreatment, combined nitrogen plasma - chitosan pretreatment at RF power 50 W. treatment time 0.5 min. and chitosan pretreatment were 303.7116, 399.5774 and 401.8398, respectively.

A04: Plasma and Nuclear Fusion (Poster) / 804**Effect of zinc on the corrosion of SS 304 in H₂O₂**

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Zinc injection has been proven to be an effective protocol for corrosion mitigation in nuclear industry. However, the role of zinc ions in this process is still not fully understood. In the present research, effort has been made to investigate the zinc effect on the corrosion of SS 304 specimens immersed in H₂O₂ solutions with addition of zinc. The surface morphology and chemical composition of the material after immersion were studied using SEM-EDX. The results have shown that zinc injection helps maintain the chemical composition of the steel alloy, thus minimizing the change in mechanical properties of the material in the corrosive environment.

A04: Plasma and Nuclear Fusion (Poster) / 805

Synthesis of conducting polymer by plasma polymerization

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In the present study, thin films of polyaniline conductive polymer have been deposited on glass substrate by AC Plasma Polymerization. Doped and undoped films were synthesized at the AC discharge voltage between 450 - 500 V, operating pressure of 0.13 and 0.14 Torr and the reaction time were set at 5, 10, 15, 20 and 30 minutes. For doped films, iodine powder was put inside the deposition reactor during the plasma polymerization process. The weight of the iodine used was varied as 0, 0.0087, 0.075 and 0.1726 grams in different in-situ doping deposition. Field Emission Scanning Electron Microscopy (FE-SEM) revealed dense, uniform films with the range of thickness between 41.3 – 570 nanometers. Attenuated total reflection Fourier transform infrared spectroscopic (ATR-FTIR) analysis showed the absorbance characteristics of polyaniline ring at 1300, 1450 and 1630 cm⁻¹. Energy Dispersive X-ray Spectrometer (EDS) also showed iodine profile in accordance with the initiative amount of iodine used. The electrical conductivities of the obtained films have been measured to be between 7.86×10^{-6} – 5.38×10^{-5} S/cm. The conductivities of the in-situ iodine doped polyaniline films were found to be one to two order of magnitude higher than those of the undoped films.

A04: Plasma and Nuclear Fusion (Poster) / 425

Monte Carlo simulation of an upgraded PGNAA shielding at TRR-1/M1

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This paper describes the upgraded collimator and shielding design principle for the prompt gamma neutron activation analysis (PGNAA) facility at Thai research reactor. The neutronic calculations with different geometry and material conditions are simulated using the Monte Carlo code. Then, the optimal parameters to maximize the thermal neutrons and minimize background radiations are obtained. The good results obtained here will be used for the upgraded PGNAA facility. It provides significant contribution to the system to be available in various applications.

A04: Plasma and Nuclear Fusion (Poster) / 426**Investigating a proton beam-based neutron source for BNCT using the MCNP simulation**

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Works in this project are focused on the optimization and design of a beam shaping assembly (BSA) for the boron neutron capture therapy (BNCT) based on a 30 MeV proton beam generator. The aim is to maximize the epithermal neutron flux and prevent the background radiation which is required for the BNCT designation. A set of material and geometry simulations are examined as neutron multiplier, moderator, reflector, and collimator. The final configuration consists of 0.5 cm of beryllium as a p-n converter, 15 cm in radius of uranium as a neutron multiplier, 44 cm of TiF₃ and 15 cm of Al₂O₃ as a first and second layer of moderator, 10 cm thick of lead as a reflector, and lithium polyethylene as a collimator. According to the results of the calculation, the proposed BSA provides high epithermal neutron flux at the irradiation area.

A04: Plasma and Nuclear Fusion (Poster) / 428**Measurement of 1-MeV C-ion beam induced X-ray production cross sections of Fe, Nb, Ru, Ce and Ta**

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While the cross sections of heavy ion beams at energy of a few MeV and above have been measured and reported, experimental data, especially of those minor lines from uncommon materials, for lower-energy heavy ion beams around 1 MeV are lack. In this study, we used 1-MeV C-ion (83 keV/amu) PIXE (particle induced X-ray emission) to measure the X-ray production cross sections of Fe K-line, Nb, Ru and Ce L-line, and Ta M-line from thin films of the materials. The literature-reported experimentally measured Fe K α cross section for standard 2-MeV proton beam was used as a reference. The measured data were compared with those PWBA- and ECPSSR-theoretically calculated by program ISICS11 and found their deviations from the theoretical predictions in acceptable ranges.

A04: Plasma and Nuclear Fusion (Poster) / 464**Assessment of Radiological in the Beach Sand from Pattani Province**

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Abstract : Specific activities of natural (⁴⁰K, ²²⁶Ra and ²³²Th) radionuclides in 250 beach sand samples collected from 5 beaches in 5 districts which are Rachadapisek beach in Nong Chick district, Talokapo beach in Yaring district, Panarae beach in Panarae district, Wasukri beach in Saiburi district and Pamai beach in Mai Kaen district in Pattani province, have been studied and measured. Experimental results were obtained by using a high-purity germanium (HPGe) detector and gamma spectrometry analysis system and also evaluated by using the standard reference materials IAEA-SOIL-6 which were obtained from Office of Atoms for Peace. Experimental set-up and measurement were operated and carried out at laboratory research building, Office of Atoms for Peace, Bangkok. It was found that, the mean values of specific activities of ⁴⁰K in Rachadapisek, Talokapo, Panarae, Wasukri and Pamai beaches were 427.58 ± 14.09 , 1090.62 ± 54.28 , 463.95 ± 14.06 , 449.07 ± 13.80 and 433.49 ± 12.77 Bq/kg, respectively. The mean values of specific activities of ²²⁶Ra were 31.10 ± 7.63 , 160.68 ± 8.07 , 84.41 ± 13.09 , 33.98 ± 7.76 and 44.42 ± 10.17 Bq/kg, respectively. The mean values of specific activities of ²³²Th were 11.40 ± 1.75 , 356.65 ± 6.59 , 74.50 ± 3.07 , 16.04 ± 1.78 and 26.86 ± 2.08 Bq/kg, respectively. Furthermore, the results of the specific activities of natural radionuclides (⁴⁰K, ²²⁶Ra and ²³²Th) in this areas were also used to evaluate the absorbed dose rates in air (D), the radium equivalent (Raeq), the external hazard index (Hex) and the annual effective dose rate in this area. Furthermore, experimental results were also compared to research data in the southern region of Thailand, the Office of Atoms for Peace (OAP) annual report and the recommended values which were proposed by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1988, 1993, 2000).

A05: Nanoscale and Surface (Poster) / 814

Using various metal phthalocyanine mixed with graphite for selective electrodes of electronic tongue to classify several types of hot drink

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Metal phthalocyanine (MPc) is a metal organic compound which can be formed with several metal atoms at the center. Although MPc has semiconductor property, in order to fabricate the selective electrode for cyclic voltammetry (CV) measurement, the other material with high electrical conductive materials is required to mix in order to achieve sufficient electrochemical current. In this work, graphite powder with particle size less than 20 μm from Sigma-Aldrich Pte. Ltd. was mixed with several MPc powders including cobalt, iron, zinc and manganese phthalocyanine powders in the ratio of 20:1 by weight, respectively. The mixture powder was grinded together to achieve the uniform mixing with some powder size. In order to fabricate the selective working electrodes, the mixture was fill into a hollow Teflon rod with inner copper rod at the other end. During CV measurement, the electrodes indicated the anodic and cathodic peaks at various voltage depending on the type of metal atom of MPc therefore these modified graphite electrodes are suitable to be utilized as a selective probe for electronic tongue system. To demonstrate the classification ability of this electrode array, a variety of hot drink was used including three types of coffee, cocoa and chocolate malt. The hot drink was prepared with boil water and cooled it down to 30°C before performing the CV measurement by five electrodes. With principle analysis, the extracted feature can separate each data group of five hot drinks and even can distinguish three types of the coffee. Thus, these graphite modified electrodes can be utilized in an electronic tongue application with low cost and high stability.

A05: Nanoscale and Surface (Poster) / 730

Green Synthesis and Characterization of Silver Nanoparticle using Natural Reducing Sugar from Cultivated Banana Peel

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Banana is a typical fruit in Southeast Asia which has value in addition to being a food source. Agricultural and plantains processing industries generate enormous amount of waste in the form of banana peel. It is renewed that banana peel has several forms of biomass resources exist (such as starch or sugar crops, weeds, and oils plants, etc.) which can utilize for reducing agent in chemical synthesis. Therefore, this research aims to synthesize silver nanoparticles by a green synthesis using an extract derived from cultivated banana peel waste. To explore optional synthesis condition, characterization of synthesized silver nanoparticles (AgNPs) using UV-visible spectroscopy and Fourier transform infrared spectroscopy (FT-IR) were investigated. Besides, reducing sugar quantities of banana peel extract (BPE) was determined using DNS standard addition method. The results revealed that green synthesis of silver nanoparticles (AgNPs) were accomplished using silver nitrate and BPE as the reductant. The optimized conditions for the AgNPs synthesis was a temperature of 60°C, 1.0 mM AgNO₃, and a reactant ratio of 1:2 (AgNO₃ to BPE). UV-Visible spectra demonstrated absorbance at 400 nm and 510 nm corresponding to AgNPs with the particle size in the range of 20-30 nm and 90-100 nm, respectively. Moreover, FTIR spectra revealed the role of functional group in BPE as a reducing agent of silver ions.

A05: Nanoscale and Surface (Poster) / 763

Facile synthesis of high purity nano-silica xero-gel from rice straw ash

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Abstract

High purity nano-silica xerogel was synthesized from rice straw ash that is a residue materials from agriculture. To obtain the rice straw ash for preparing of sodium silicate that is then used as silica source, pretreated rice straw was burned at 600-900 oC. Rice straw ash was reacted with 0.5 M NaOH for 3-12 h and filtrated by a no.41 filter to prepare sodium silicate. Afterwards, sodium silicate was mixed with 0.5 M HCl for 6 h to produce the nano-silica. In this study, nano-silica was synthesized by using a template, as well. Characteristics of nano-silica synthesized with and without template were compared. In order to get the pure nano-silica xerogels, as-synthesized silica was filtrated and clean with deionized water for 3 times, dried in electric oven at 85 oC overnight and calcined at 500 oC. To confirm the quality of particles, nano-silica was characterized by various analytical techniques like SEM, TEM, XRD, FTIR-ATR, BET, % whiteness and measurement of water contact angle. First experimental results showed that nano-silica xerogels with purity up to 99 wt% were completely synthesized by a facile method. Nano-silica with intermediate specific surface area and

pore volume was obtained. Experimental results also showed silica-xerogels with good absorption properties.

Keywords: Rice straw ash; Nano-silica; Xerogel; Facile-method; Surface area.

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In-situ current annealing of graphene-metal contacts

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The issue of contact resistance between graphene and metal contacts is crucial in the development of high-speed graphene devices. However, fabrication-related contamination severely affects the contact resistance in graphene and hence an effective post-fabrication method is needed to resolve this problem. Current-induced cleaning has previously been used successfully to clean the surface of graphene using the concepts of Joule heating. However, its effect on the graphene-metal contact resistance has not been well documented. By studying as many as 30 devices with varying sample sizes and geometry, we demonstrate that current-induced annealing may be used as an effective in-situ annealing procedure to improve the graphene-metal contact resistance which has long been an issue in characterizing graphene-based devices. With this technique, we are able to reduce the overall resistance systematically to around $1000 \Omega\text{-}\mu\text{m}$, which is competitive with the best values obtained in the literature to treat this problem. We also demonstrate the effectiveness of current annealing in desorbing contaminants from the surface of the graphene layer, simultaneously shifting the charge-neutrality point to zero back-gate voltage, thus allowing the tuning of carrier density on both the electron and hole sides of the Dirac spectrum.

A05: Nanoscale and Surface (Poster) / 800

Broad Spectral Photodetectivity of CoPc/a-IGZO Hybrid Thin Film Phototransistor

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In this research, the incorporating of cobalt phthalocyanine (CoPc) absorption layer on amorphous indium-gallium-zinc oxide transistor was proposed to enhance a broad spectral and responsivity of photodetector from ultraviolet to visible regime. A wide-band-gap IGZO film was used as a semiconducting channel and UV absorption layer, while small-band-gap CoPc film was decorated for converting visible light absorption to an electrical signal. The result showed that the CoPc-incorporated phototransistor has higher responsivity than IGZO transistor under illumination of a 635 nm laser. In addition, a good stability and reduced PPC effect of IGZO-based hybrid transistor have also approached. These result indicate that the proposed hybrid CoPc/a-IGZO phototransistor is suitable for applying as UV-visible light detector.

A05: Nanoscale and Surface (Poster) / 443

Surface Improvement of Stainless Steel by DLC Coating for Biomedical Application

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Surface improvement of stainless steel (AISI 316L) by coating films for biomedical application was investigated. The DLC, TiN and TiCN films were deposited using Physical Vapor Deposition (PVD) technique. The structure of DLC film was analyzed using Raman spectroscopy. The composition of the films was measured using energy dispersive X-ray spectroscopy. The contact angle of the films was measured using contact angle measurement. The adhesive strength between the film and substrate was measured using scratch tester. The corrosion performance of the films was conducted using potentiodynamic polarization. The cell viability on the films was conducted using cytotoxicity test. The results indicate that the films show lower contact angle (80.75° to 87.79°) than un-coated AISI 316 L sample (96.63°), the tendency of wettability and hydrophilicity. This is due to the high surface roughness of films affecting the low contact angle. The TiCN, DLC and TiN films showed a corrosion potential values of -0.353 V, -0.58 V and -0.68 V, respectively, which show that the good corrosion resistance. This is due to the formation of a passive film and the sp³ sites structure of DLC film. The DLC film showed highest cell viability percentage of 104%, which show that the good biocompatibility properties.

A05: Nanoscale and Surface (Poster) / 507

Synthesis and room-temperature ferromagnetism in flower-like SnO₂ nanostructures

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Abstract. The flower-like nanostructures of SnO₂ were successfully synthesized by a simple hydrothermal method. The structure of the flower-like samples was investigated by X-ray diffraction (XRD). The samples revealed the single phase of SnO₂ tetragonal structure. The corresponding selected-area electron diffraction (SAED) analysis further confirmed the formation of the tetragonal structure of SnO₂ without secondary phases. The UV-visible spectroscopy showed the absorption peaks of SnO₂ flower-like samples in ultraviolet region centered at approximately 275 nm (4.37 eV). The estimated band gap of the samples was in the range of 3.47-3.52 eV. The magnetic properties were investigated by VSM. The flower-like sample prepared at 180°C for 48 h exhibits a diamagnetic behavior, whereas the sample prepared at 180°C for 24 h is ferromagnetic having the saturation magnetization of 0.574 memu/g at 15 kOe.

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Shape Control in Zinc Oxide nanostructures by Precipitation Method

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Zinc oxide nanostructures are of eminent importance for the field of chemical sensors, field effect transistors, transparent conductors and ultraviolet light emitting devices. Work in this project is

focused on the synthesis and characterization of nanorods and nanoparticles of zinc oxide (ZnO) by precipitation method. The morphology of the samples can be controlled by adjusting the amount of NaOH and citric acid in the NaOH or citric acid/water system. X-ray diffraction (XRD) analysis reveals the single phase of ZnO hexagonal wurtzite structure. The Fourier transform infrared spectroscopy (FT-IR) was used to classify functional groups and types of chemical bonds of the samples. The morphology of the samples was investigated by Field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM). UV-vis spectroscopy was also performed to study the optical properties of ZnO nanostructures. The estimated band gap of ZnO samples was in the range of 3.68-3.71 eV.

A05: Nanoscale and Surface (Poster) / 522

XPS and XAS studies of diamond-like carbon films prepared by HIPIMS technique

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X-ray photoelectron spectroscopy (XPS) and x-ray absorption spectroscopy (XAS) were employed for the investigations of diamond-like carbon films prepared by HiPIMS technique. The measurements were done ex-situ, i.e. the prepared DLC samples were exposed to air during transferring from the deposition to analysis chambers. It is inevitable that the surface of the samples was contaminated by absorbed air molecules. XPS analyses revealed that the main surface contaminants are carbon and oxygen, which introduce the difficulties for the determination of carbon species in the DLC films. In this work, a complementary XAS technique was used for analyzing carbon species in the DLC films. The XAS measurements were carried out in a fluorescence mode to probe beneath the surface, avoiding collecting information from the surface contaminations. The results from the surface sensitive XPS technique will be compared with the XAS results, and the discussion will also be made.

Keyword: Diamond-like carbon; DLC; XAS; XPS; HIPIMS

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Effect of Organic Cation on Defect States of CH₃NH₃PbI₃ Perovskite Films Prepared by an Ultrasonically Sprayed- Nebulous Deposition Method

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Methyl ammonium lead iodine CH₃NH₃PbI₃ based perovskite with low degree of disorder is of great interest for optoelectronic and photovoltaic applications. In this work, a layer of CH₃NH₃PbI₃ has been successfully deposited on fluorine doped tin oxide (FTO) coated on glass by an ultrasonically sprayed-nebulous method. Changes in their structural and optical properties along with details of

photo-induced charge separation and transportation behaviors upon the perovskite conversions induced by the amount of organic cation are systematically examined by X-ray diffractometry (XRD), UV-vis spectroscopy and surface photovoltage spectroscopy (SPV), respectively. The SPV spectra reveal a significant reduction of the deep defect states when increasing the number of organic content, which is indicative on a passivation of the defects. The Urbach energy (E_u) related to the degree of disorder in the films is quantified from the absorbance spectra, from which the measured values of E_u decrease from 33.36 to 28.24 meV as the amount of organic content is increased to the optimum condition. We present that the utilization of ultrasonically sprayed-aerosols deposition has a potential for fabricating high quality of $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite.

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Effects of Cs-doping in Formamidinium Lead Triiodide Perovskite films on improved phase stability and charge separation

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Herein, polycrystalline of cesium (Cs) doped in formamidinium lead triiodide ($\text{HC}(\text{NH}_2)_2\text{PbI}_3$ or FAPbI_3) films were successfully prepared by spin-casting from solutions. Changes in structural, optical and morphological properties of the obtained films upon varied Cs concentrations were systematically investigated. A phase stability and the grain sizes of the films are very strongly dependent on the amounts of Cs dopants. XRD results reveal that a phase transition from an unstable δ -phase to the stable α -phase of the perovskite films with an increase in the grain size up to ca. $1 \mu\text{m}$ was clearly observed when the film was doped with 0.1% at Cs. A decrease in the lattice parameters of the film due to the substitution of Cs^+ ions into FA^+ sites in the FAPbI_3 structure was quantified. An optical band gap of the films exhibits a blue shift from 1.52 eV for an undoped FAPbI_3 film to 1.56 eV for the film doped with 0.1% at due to a quantum-size effect. Effects of Cs doping in the FAPbI_3 films on the charge separation and charge transport behaviors as probed by surface photovoltage (SPV) spectroscopy will be presented and discussed.

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CIGS thin film solar cells with graded-band gap fabricated by CIS/CGS bilayer and CGS/CIS/CGS trilayer systems

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High efficiency $\text{CuIn}_{1-x}\text{Ga}_x\text{Se}_2$ (CIGS) thin film solar cells are usually deposited on Mo-coated soda-lime glass (SLG) substrates by the three-stage co-evaporation process which is intended to create double-graded band gap. It requires short total deposition time and changing of substrate temperature in order to obtain the double-graded band gap which is quite difficult for high source temperatures. When the total deposition time cannot be made short enough, uniform band gap is rather achieved. On the other hand, in this work, the depositions of CIS/CGS bilayer systems are employed in order to create front and back grading while CGS/CIS/CGS trilayers are for the double-grading,

owing to non-uniformity and different diffusivity of In and Ga constituents in the films. In addition, the substrate temperature is held steadily at 560°C throughout the deposition of bilayers and trilayers in contrast to that of the three-stage process. The bilayers with back grading show the increasing short-circuit current density (J_{sc}) due to the assisting back surface field, but the open-circuit voltage (V_{oc}) is relatively low due to the reduction of Ga content at the front surface. For the CGS/CIS/CGS trilayers, double grading and the increasing of V_{oc} are observed when compared with the bilayers due to the increasing Ga content near the junction. The highest efficiencies of the devices fabricated from the CIS/CGS bilayer and CGS/CIS/CGS trilayer absorbers show the maximum value of 12.5% and 15.5%, respectively. The external quantum efficiency (EQE) of the bilayer and trilayer absorbers indicate the enhancement in the long wavelengths compared to that of the three-stage process absorbers.

A05: Nanoscale and Surface (Poster) / 563

Atomistic Molecular Dynamics Simulation of Graphene-isoprene Nanocomposites

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Graphene-polymer nanocomposites have attracted some attentions from researchers recently due to its potential applications as a stress sensor or a lightweight-flexible conductor. A series of atomistic molecular dynamics simulations were performed for the systems consisting of a graphene flake within 4-mer isoprene matrix to assess the conformational order of isoprene molecules at the matrix-filler interphase. Two sizes (1.35 nm and 2.5 nm diameters) of graphene flakes were examined along with pure 4-mer isoprene melt. Local density and orientation of rubber polymer chains were measured as a function of distance from graphene. The interaction ranges between 4-mer isoprene and graphene, and between a pair of 4-mer isoprene chains were analyzed. These results provide some useful information for further research on rubber nanocomposites.

A05: Nanoscale and Surface (Poster) / 576

Fabrication of chitosan and calcium carbonate bio-crystals for humidity sensor prepared from annealed shrimp and egg shell

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Abstract. We reported the humidity sensor free catalyst prepared from shrimp and egg shell. The annealed shrimp and egg shell were ground to be powder and mixed together with various ratios. The samples were characterized and investigated by X-ray diffraction technique (XRD), Scanning electron microscope (SEM) and humidity sensing. Therefor, XRD pattern of shrimp and egg shell show chitosan and CaCO_3 structures, respectively. Their SEM images indicate massive agglomeration of morphology. Moreover, the humidity sensor demonstrates highest sensitivity of shrimp and egg shell ratio of 1:1 for 4.81 at 85%RH. However, the resistance and relative humidity relationship indicates non-linear.

A05: Nanoscale and Surface (Poster) / 595

Vertical Wall Cavity on (100) Silicon Processed by Concentrated NaOH solution agitated with ultrasonic coupled with Mechanical Rotation

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This work aims to evaluate the use of concentrated sodium hydroxide solution to etch silicon (100) substrate under solution agitation by ultrasonic coupled with mechanical rotation for achieving vertical etched sidewall. Experimental trials were conducted by design of experiments with full factorial design. Factors considered here compose of; sodium hydroxide concentration, solution temperature and substrate rotation speed with the setting value in the range of 15-45%wt, 40-60°C and 3-15 rpm, respectively. Etched wall angle and etch rate were considered as response which targeting vertical wall and maximum etch rate. Experimental results provide etching recipe that provide vertical wall and highest etch rate by setting etching condition as NaOH concentrated at 45%wt, solution temperature at 60°C and 3 rpm substrate rotation speed. The etched surface is smooth possess the roughness at 33.66 nm.

A05: Nanoscale and Surface (Poster) / 676

Linear aggregation of spherical nanogolds in carbon nanotube suspension under influence of AC electric field.

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We reported a novel method to align spherical nanogolds into linear chains, mediated by induced-electric dipoles from carbon nanotubes in the suspension under AC field. Nanogolds were suspended along with carbon nanotube in water under an AC field of magnitude 100 volts/mm and frequency range of 25 - 1,000 KHz. Typically the electric polarization of nanoparticles are very small because of their small volume and we did not observe their dipole-dipole interaction forces under the presence of electric field. However, introducing carbon nanotubes into the suspension made the nanogolds interact with each other and form linear chains directed along the field line. We also found that linear chains can attract from the side and form fatter chains.

A05: Nanoscale and Surface (Poster) / 700

Effects of PVP and PEG on the morphological structure, hydrophilicity and mechanical properties of PSF/NH₂-SiO₂ composite membranes

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Abstract

This research studied the effects of PVP and PEG on morphology, hydrophilicity and mechanical properties of the PSF/NH₂-SiO₂ composite membranes. To study the chemical and physical properties, pure polysulfone (PSF) and nanocomposite PSF/NH₂-SiO₂ membranes were prepared. PVP and PEG at different loading were incorporated into the matrix of PSF membranes. Phase inversion technique was employed to forming of membrane. Composition and temperature of coagulation medium were controlled. The characteristics of prepared membranes was analyzed by using various analytical techniques. Hydrophilicity of membrane surface was determined through the measurement of water contact angle. Morphological structure, pore size and pore size distribution were studied through SEM image combined with computer software, Carnoy 2.0®. While tailoring of functional groups and mechanical properties were evaluated by FTIR-ATR and DMTA techniques, respectively. The results showed that introducing of PVP and PEG affect to the pore structure, pore size distribution and hydrophilic properties of PSF/NH₂-SiO₂ composite membranes. Result from DMTA revealed that modulus and mechanical strength of membrane sample was modified by incorporation of PVP and PEG. Glass transition temperature (T_g) of the prepared membranes slightly increased. As can be seen from the experimental results, it was confirmed that PVP and PEG affected to chemical and physical properties of PSF/NH₂-SiO₂ membranes.

Keywords: Composite membrane; Morphological structure; Hydrophilicity; PVP; PEG

A05: Nanoscale and Surface (Poster) / 713

CuO_x/SnO₂ nanostructures by microwave-assisted thermal oxidation for ethanol sensing

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In this work, CuO_x/SnO₂ nanostructures were synthesized by a microwave-assisted thermal oxidation. Mixture of Sn and Cu₂O with various ratio was loaded into a cylindrical quartz tube and further radiated in a microwave oven under atmospheric ambient. The as-synthesized products were characterized by transmission electron microscope and x-ray diffractometer. The results showed that CuO_x/SnO₂ nanoparticles were obtained in two minute of microwave radiation. Brown content of the products was increased as amount of Cu₂O in the mixture increasing. Most of the products were in nanoparticle form with the diameter ranging from 20 to 150 nm. The SnO₂ nanoparticles were in the cassiterite rutile structure phase. Both CuO and Cu₄O₃ phase were observed in the products and confirmed to be monoclinic and tetragonal phase, respectively. In addition, the CuO_x/SnO₂ nanoparticles were applied as ethanol sensor. The results showed that the CuO_x/SnO₂ nanoparticles exhibited extra high sensitivity to ethanol vapor.

A05: Nanoscale and Surface (Poster) / 723

Effect of CaCO₃ nanoparticles and synthesized ZnO nanoparticles on the properties of natural rubber

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The effect of the synthesized zinc oxide nanoparticles (sZnO) and calcium carbonate nanoparticles (NCC) on the cure characteristics and mechanical properties of natural rubber were investigated. The sZnO synthesized by microwave assisted aqueous precipitation method using zinc nitrate hexahydrate and sodium hydroxide as a precursor. The morphology of the sZnO is a spherical shape with the average primary size of 46.63 nm and the specific surface area of $38.87 \text{ m}^2 \text{ g}^{-1}$. For the NCC is a commercial grade with the average primary size of 66.67 nm and the specific surface area of $28.97 \text{ m}^2 \text{ g}^{-1}$. Based on the obtained results, in the unfilled natural rubber, sZnO can be reduced successfully from 5 to 1 phr compared to conventional ZnO (cZnO) and increase tensile strength, 300% modulus and elongation at break by 11%, 9% and 11%, respectively. In case of sZnO and NCC filled with natural rubber, it increases tensile strength, 300% modulus and tear strength by 19%, 19% and 18%, respectively compared to conventional grade (cZnO and CC) in microparticles. This benefit is due to small grain size and large specific surface area of nanoparticles.

A05: Nanoscale and Surface (Poster) / 738

Growth of Doped-Al ZnO Thin Film under N₂ gas as the Electrode for Solar Cell Deposited by Asymmetric Bipolar DC Magnetron Sputtering Technique

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ZnO(Al) thin films were prepared by asymmetric bipolar dc magnetron sputtering technique as the transparent electrode for solar cell. ZnO(Al) target was prepared at the surface ratio ZnO:Al of 45 : 1. ZnO(Al) thin films were grown by the deposition time of 10, 20, 30, 40 and 50 minutes, respectively. Moreover, growth of ZnO(Al) thin films the deposition time for 30 minutes was doped by N₂ gas at the flow rate of 5, 10 and 15 sccm, respectively. Optical, structural, morphological and electrical properties of ZnO(Al) thin films were analyzed by UV-vis spectrophotometer, X-ray diffraction (XRD), field emission scanning electron microscope (FE-SEM), linear four-point probetechnique and Hall effect measurement, respectively. Transmission values of a film at doped N₂ gas flow rate of 5 sccm is as high as 71% and low reflection. ZnO(Al) thin films has high crystal. The average grain sizes are approximately of 198 – 263 nm which the highest average grain size obtains from a film at doped N₂ gas flow rate of 5 sccm. The resistivity values of ZnO(Al) thin films are 2.33E-01, 1.63E-01, 1.52E-02 and 4.24E-03 •m. The carrier concentration (n) are 3.48E+18 to 6.42E+18 cm⁻³ which found that the carrier concentration somewhat highly and behaviours n-type semiconductor-like. ZnO(Al) thin film deposited under doped N₂ gas can be generated a carrier more than a films non-doped N₂ gas which the suitable for application to fabrication of transparent electrode for solar cell.

A05: Nanoscale and Surface (Poster) / 748

The Optical Band Gap of Perovskite Materials for Solar Cells

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Perovskite thin films $CH_3NH_3PbCl_{3-x}Cl_x$ in this project are deposited by two-step deposition method to study the effect of chloride on the optical band gap. In this experiment, the band gap is insignificantly increased from 1.60 ± 0.01 eV with no Cl-doping to 1.62 ± 0.01 eV with 16% Cl-doping because some chloride ions cannot replace the iodide positions in $CH_3NH_3PbI_3$ and form $CH_3NH_3PbCl_3$ instead. Though the crystal structure of $CH_3NH_3PbI_3$ is cubic, with heavily Cl-doping, the crystal structure of $CH_3NH_3PbCl_{3-x}Cl_x$ becomes tetragonal and longer annealing time results in the leaving of Chloride in $CH_3NH_3PbCl_{3-x}Cl_x$. The presence of residual PbI_2 also affects the photon absorption of perovskite.

A05: Nanoscale and Surface (Poster) / 751

The Influence of Surface Preparation by Laser Process on the Properties of DLC Film

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The objective of this research was to study the influence of surface preparation by laser process on the properties of DLC Film coated on Stainless steel 316L samples. The parameters of surface preparation included laser power and laser speed were set at 3 levels. The treated sampled was coated by DLC films at 500 nm film thickness. Average surface roughness was measured by Surface roughness tester. Adhesion strength between film and substrate interface was measured by scratch tester. Friction coefficient was performed by Tribometer with Ball on disk type. The results indicate that with the increasing laser power, average surface roughness and friction coefficient increases. Additionally, with the increasing laser speed, adhesion strength increases.

A05: Nanoscale and Surface (Poster) / 757

Influence of temperature annealing on structural and optical properties of α - MoO_3 films prepared by a spray pyrolysis method

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Layers of polycrystalline molybdenum trioxide (MoO_3) thin films were successfully deposited on fluorine-doped tin oxide (FTO) coated glass by a spray pyrolysis technique at the deposition temperature of 425°C for 1 hour. The prepared films were further annealed at 500 °C for 0.5, 1, 1.5, 2 and 3 hours. The effect of the annealing periods of time on their structural, morphological and optical properties was methodically investigated. The XRD results indicate that the films show high crystallinity with an orthorhombic crystal structure of α - MoO_3 phase after the post-annealing treatment. The films annealed for 1 hour exhibit the strongest (020) preferred orientation with their lattice parameters of $a = 3.939$ Å, $b = 13.728$ Å and $c = 3.682$ Å. The surface morphology of the films presents rod-like particles and their sizes appear to become larger with increasing the annealing times. The values of optical band gap of the films obtained from absorbance spectra are varied in a range of 3.02-3.32 eV, depending on the annealing times.

A05: Nanoscale and Surface (Poster) / 758

Stability and physical properties of Mn-doped ZnO monolayer

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Recently, monolayer of ZnO has successfully been synthesized on graphene. It leads to a new class of 2D oxide materials which have many promising properties such as high optical transparency, hazard gas capture etc. To improve to use in a spintronic application, Mn is doped into ZnO by many previous studies. Here, this study aims at investigating stability, electronic and magnetic properties and CO absorbance of ZnO monolayer doped with Mn atom by means of *ab initio* calculation. Mn atom is substituted at a cation Zn position of the ZnO monolayer with the cell sizes of 2×2, 2×4 and 4×4 which correspond to 50 and 25, 12.5, and 6.25 Zn-at%Mn, respectively. The finding shows that all Mn-doped ZnO monolayers are stable in the thermodynamic stability and the binding energy decreases with increasing atomic percentage of Mn atom. The Mn-doped ZnO monolayer exhibits a ferromagnetic semiconductor as mainly due to the strong 2p-O and 3d-Mn mixing orbital. The band gap of undoped ZnO monolayer is larger than the band gap of wurtzite ZnO about 1 eV which is in agreement with experimental result (~0.7 eV). We also find that the band gap of Mn-doped ZnO is reduced by number of Mn atoms, this situation might be influenced by the spin polarization of 3d-Mn state below the Fermi level. The distortion of O atoms surrounding a Mn atom is occurred because the nature of Mn is a better oxidant than Zn atom. Moreover, Mn atom tend to attract C atom in CO molecule but extrude O atom. These results might be potentially useful for the spintronic application, the development of magnetic 2D oxide materials, and CO absorbance.

A05: Nanoscale and Surface (Poster) / 759

Synthesis and characterization of monodisperse mesoporous TiO₂ using different templates

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Abstract

This study aims to investigated the synthesis of single-phase nano-titanium using titanium (IV) isopropoxide (TTIP) as a precursor and two types of surfactant as structure directing agent or template; CTAB and TTAB. Double-phase and co-condensation techniques are employed for the synthesis. The formation of titanium nanoparticles occurs at about 60-80 oC under atmospheric pressure and the basic environment. To obtain a single-phase nano-titanium, the obtained as-synthesized TiO₂ are dried and burned at 500-550 °C. The burned particles are then analyzed and tested with various analytical techniques. Water retention is analyzed by dripping with deionized water (DI-water). Surface area and porous volume were analyzed by BET technique while the size and distribution of porosity were analyzed by BJH method with nitrogen adsorption (N₂-isotherm). Morphology and internal nanostructure of particles were analyzed through the SEM and TEM techniques. Composition of particle was analyzed by XRD technique and tailoring of functional groups on particles were analyzed by TGA and FTIR techniques. UV-vis technique was used to determine the energy band gap. Results from preliminary experiment showed the successful synthesis of TiO₂ nanoparticles with highly porous surfaces in which can be utilized in various applications like preparation of nanocomposite membranes, agriculture and solar cells.

Keywords: Synthesis; Monodisperse; Mesoporous; TiO₂; Nanoparticles.

A06: Condense Matter and Accelerator (Poster) / 639

Study on Penetration of 4 MeV Electron Beam in Natural Rubber Latex

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Vulcanization with electron beam irradiation provides unique and high efficient processing for natural rubber latex. It is one of very interesting and effective industrial applications of particle accelerators. A 4-MeV RF linear accelerator and electron beam irradiation system have been developed for natural rubber vulcanization at the Plasma and Beam Physics Research Facility, Chiang Mai University. This accelerator will be able to produce electron beams with adjustable energy in a range of 0.7 to 4 MeV. The beams with different energies provide different doses and different distributions in the rubber latex. In this research, we used a Monte Carlo simulation program called GEANT4 to study transportation of 4-MeV electron beam with Gaussian transverse distribution through a vacuum window, an air gap and natural rubber latex. The vacuum window is made of 50-micron titanium foil and the natural rubber was placed 18 cm downstream the foil exit. Simulations of electron transverse and depth dose distribution in these materials were conducted. In addition, calculation on the irradiation throughput from this process was performed. The study results revealed that the 4-MeV electron beam with Gaussian distribution can penetrate uniformly about 0.8 cm in the natural rubber latex with the RMS transverse size of 1.4 mm at the rubber surface. The electron beam irradiation of about 0.02 second will provide the dose of around 50 kGy per irradiated point, which is enough for the rubber vulcanization process.

A06: Condense Matter and Accelerator (Poster) / 644

Investigation on Electron Absorbed Dose in a Mixture of Natural Rubber Latex and Cross-linking Agents

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Natural rubber vulcanization using electron beam is one of interesting applications of electron linear accelerators with an energy in a range of a few hundred keV to a few MeV. At the Plasma and Beam Physics Research Facility, Chiang Mai University, a 4-MeV RF linear accelerator (linac) is developed for utilizing in natural rubber vulcanization. To accelerate the vulcanization process, cross-linking agents are added in a natural rubber latex to increase the bonding probability between the chains of the rubber molecules. Therefore, some properties e.g. molecular mass and density of the natural rubber latex are changed. This research uses Monte Carlo method in the program GEANT4 to simulate the electron absorbed dose in a mixture of natural rubber latex and cross-linking agents. The initial

electron beam distributions are obtained from the beam dynamic simulation in the linac, which were done with the program ASTRA. The initial electron beams have mean energy in the range of 0.69 to 4.00 MeV at the position 6 cm prior the 50- μm titanium vacuum window foil. The air gap distance between the vacuum window to the natural rubber latex was set at 18 cm. The electron beam transportation in the titanium foil, air gap and a mixture of natural rubber latex were simulated. The cross-linking agents that are added in the natural rubber latex are ethylene glycol dimethacrylate (EDMA) and 1,6-hexanediol-diacrylate (HDDA). Finally, electron absorbed dose distributions in both transverse direction and along the depth of the natural rubber latex mixed with each cross-linking agent are calculated and analyzed. The results from this work can be used for experimental planning in order to irradiate the natural rubber latex with appropriate portion of cross-linking agents and electron absorbed dose.

A06: Condense Matter and Accelerator (Poster) / 656

New High-Pressure Phase and Properties of Thallium under High Pressure: An ab initio investigation

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In the recent work, we have demonstrated the high-pressure phase transitions of a heavy element thallium (Tl). The known first phase transition from h.c.p. to f.c.c. is initially investigated by various relativistic levels and exchange-correlation functionals as implemented in FPLO method, as well as scalar relativistic scheme within PAW formalism. The electronic structure calculations are interpreted from the perspective of energetic stability and electronic density of states. The full relativistic scheme (FR) within L(S)DA performs to be the scheme that resembles mostly with experimental results with a transition pressure of 3 GPa. The s-p hybridization and the valence-core overlapping of 6s and 5d states are the primary reasons behind the f.c.c. phase occurrence. The electron-phonon coupling and the superconducting critical temperature (T_c) as a function of pressure are evaluated. The findings show that both T_c 's of h.c.p. and f.c.c. phases decrease with increasing pressure and the T_c of f.c.c. phase approaches zero at 30 GPa. We have also uncovered the unusual distortion in face-centered cubic (f.c.c.) phase, namely the body-centered tetragonal (b.c.t) phase, of Tl which is induced by the high pressure at approximately 83 GPa. This prediction has been confirmed by experimental results of using an angle dispersive X-ray diffraction technique. The reversible b.c.t. \rightarrow f.c.c. phase transition of Tl is predicted around 800 GPa. Our finding provides the extension of the phase diagram of Tl under high pressure as h.c.p. \rightarrow f.c.c. \rightarrow b.c.t \rightarrow f.c.c.

A06: Condense Matter and Accelerator (Poster) / 667

Simple model for relation between magnetoresistance and thickness of insulating layer in ferromagnet/insulator/ferromagnet junction

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Using the modified Slonczewski model, we studied the relation between the maximum change in magnetoresistance in an applied field and the thickness of the insulating layer in a ferromagnet/insulator/ferromagnet junction. We found that the maximum change in magnetoresistance varies linearly with the width of the insulating layer. We also found that in the high barrier case, the saturation field, the magnitude of applied field in which the maximum change is reached, depends very little on the width, but decreases with the width in the low barrier case.

A06: Condense Matter and Accelerator (Poster) / 671

Pressure-induced hydrogen storage mechanisms of TM-doped MgH₂

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Hydrogen storage technology has attracted a worldwide interest for enhancing the efficiency of hydrogen energy carrier used in a clean energy innovation mobile car. In this work, ab initio study of hydrogen storage mechanisms in Magnesium hydride (MgH₂) with doping transition metals (TM) was analyzed. High-pressure and structural effects on the doped MgH₂ were examined. The conventional cells were optimized and calculated the physical properties using Kohn-Sham equations with GGA-PBE functional. Enthalpy of formation and the potential barrier of kinetics hydrogen diffusion were analyzed under pressure increasing. It was found that Ni and Pd reduces enthalpy of formation and the potential barrier of kinetics hydrogen diffusion in the doped MgH₂.

A06: Condense Matter and Accelerator (Poster) / 685

Enthalpy of formation of CsSn(Cl_x(Br,I)_{1-x})₃ and CsPb(Cl_x(Br,I)_{1-x})₃

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According to the third-generation of photovoltaic cell, the methylammonium lead iodide perovskite (MAPbI₃) has recently gained a great deal of interest. This is as, to date, the solar cell made of this material has been able to reach efficiencies 22.7% in 2017 and is very cost efficient to manufacture compared with that from the conventional silicon based. Such great efficiencies is attributed to their excellent features, most likely of which is the direct bandgap, high absorption coefficient and long carrier diffusion length [J. Mater. Chem. A 3, 8926-8942 (2015)]. However, the MAPbI₃ is somewhat structurally unstable under the ambient moisture, and more worse it contains the toxic lead (Pb) which is harmful to human health and environment. The existence of organic molecule in this material is a major obstacle to their stability. The effective way to remove this problem directly is to replace the organic cation with inorganic counterpart. According to the Goldschmidt tolerance factor rule, except for francium (Fr) which is a radioactive element, cesium might be the most appropriate substitution to organic site, because its atomic size is almost the largest in the periodic table to hole the stable perovskite structure. To remove the toxic effect of lead, tin metal cation is one of the most reasonable substituting for lead because it has the similar valence electronic configuration and has close ionic radius to lead, which makes it possible to form a perovskite structure [Monatsh. Chem. 148, 795-826 (2017)] In addition, mixing halide in perovskites has been verified as the effective way to refining the properties of perovskites such as tuning the bandgaps and enhancing stability. These then inspire us to pursue for families of perovskites possessing formula CsSn(Cl_x(Br,I)_{1-x})₃,

which are nontoxic and could have better structural stability under ambient conditions. Therefore, in this work, we have investigated enthalpy of formation of $\text{CsSn}(\text{Cl}_x(\text{Br},\text{I})_{1-x})_3$ with $x = 1/3, 2/3$ and 1, in the cubic phase based on the density functional theory (DFT) with the Generalized Gradient Approximation (GGA). The main objective is to seek for the characteristic of structural stability with respect to the composition x 's. We found that the structural stability increases linearly with composition x 's of halide atom from I to Br to Cl. These effects can be understood by considering at the trend of electronegativity of halide atoms which increases from I to Br to Cl. We found that the stability of $\text{CsSn}(\text{Cl}_x(\text{Br},\text{I})_{1-x})_3$ is slightly lower than $\text{CsPb}(\text{Cl}_x(\text{Br},\text{I})_{1-x})_3$. Thus $\text{CsSn}(\text{Cl}_x(\text{Br},\text{I})_{1-x})_3$ is still the promise candidate for photovoltaics. As we know that perovskites containing more Cl will have larger band gaps. Therefore, these studies could serve as a guidance to compromise the stability, by varying composition of halide atoms, with the optimal band gap or other solar-cell-desired properties.

A06: Condense Matter and Accelerator (Poster) / 706

Tangential Shimming Pole Face Simulation for Quadrupole Magnet

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Quadrupole magnets are normally used for transverse beam size control in particle accelerators. They have magnetic field properties that can focus or defocus the charged particle beam. To build an ideal quadrupole magnet is difficult because four pole faces must have hyperbolic shape. In this work, we studied tangential shimming of a pole face and simulated the magnetic field for designing a practical quadrupole electromagnet. A pole face's geometry was first created by using the MATLAB script. Then, the magnetic field was simulated with the computer program POISSON. The initial and final tangent points of each tangential line were varied to find optimal shimmed pole face geometry. We found that for a quadrupole magnet with an aperture radius of 20 mm provides the gradient of 309.75 G/cm with a tolerance of 0.05% at an excitation current of 5 A. The maximum good field region is about 18mm.

A06: Condense Matter and Accelerator (Poster) / 710

Electronic structures and band gaps of $\text{MgGe}_x\text{Sn}_{(1-x)}\text{N}_2$ semiconductors

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Wide-band-gap semiconductors such as III-N have been used as innovation components of solid state lighting devices. For instance, AlN is used to make ultraviolet LEDs [Nature 441, 325 (2006)] and GaN is used to make blue LEDs [J. Appl. Phys. 94, 3675 (2004)]. The alternative wide-band-gap semiconductors are crucial to search for other applications. The mixing of group-III elements in binary semiconductors (III-N) are considered to enable turning of band gap energy such as $\text{In}_x\text{Ga}_{(1-x)}\text{N}$, but the large lattice mismatch between InN and GaN produces phase separation in their alloys [Opt.

Commun. 237, 363 (2004)]. Thus, instead of mixing different group-III elements in binary semiconductors, the ternary compounds (II-IV-N₂) was proposed by replacing the group-III element with two elements of group-II and group-IV [Phys. Rev. B. 94, 125201 (2016)]. In this work, we study the lattice dynamics and electronic structure of nitride semiconductors MgGe_xSn_(1-x)N₂, where $x = 0, 0.25, 0.5, 0.75$ and 1 by using density functional theory (DFT) calculations. Only valence electrons were considered exactly while core electronic states were represented via ultrasoft pseudo-potentials. The exchange correlation functional was approximated by the hybrid functional (HSE). The results present lattice constants of MgGe_xSn_(1-x)N₂ compounds linearly increase with increasing Sn concentrations according to the Vegard's law and the bowing coefficients p_a, p_b and p_c are $0.0429, -0.0194$ and 0.0874 Å respectively. We also find that, in the electronic band structure, the N- p dominated valence band shifts down and Ge- s dominated conduction band moves up with increasing Ge concentrations. This computational study will serve a fundamental knowledge for band structure and defect engineering of this new family of wide-band-gap semiconductors.

A06: Condense Matter and Accelerator (Poster) / 725

RF System of Linear Accelerator for Natural Rubber Research

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The natural rubber research is ongoing project at the Plasma and Beam Physics Research Facility, Chiang Mai University, Thailand. The project aims to use electron beam irradiation for high quality vulcanization process for natural rubber. The main accelerator system consists of a DC thermionic electron gun, 5-cell linear accelerator structure, control system, RF system and electron beam irradiation system. This accelerator system aims to generate adjustable electron beam energy range from 0.5 to 4.0 MeV with pulse current of 10 – 100 mA and pulse repetition rate of 20 – 400 Hz. The 4 MeV electron beam with current of 100 mA produced at pulse repetition rate of 400Hz is expected to achieve the maximum absorbed dose of 640 Gy. The control system is designed and built in-house to fit the accelerator system requirement. The RF system consists of Pulse Forming Network (PFN), trigger board and thyatron switch, pulse transformer and pulse magnetron. This RF system can achieve RF power of 0.9 to 2.0 MW with pulse width of 4 μ s. The pulse repetition rate can be varied from 20 to 400 Hz to control RF average power. The performance of control system and RF system as well as the results of RF commissioning will be present and discussed.

A06: Condense Matter and Accelerator (Poster) / 756

Effects of Mn and Co doping at different sites in BaTiO₃ thin films on crystal structure and magnetic properties

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$Ba_{1-x}Mn_xTiO_3$ (BMT), $BaTi_{1-x}Mn_xO_3$ (BTM), $Ba_{1-x}Co_xTiO_3$ (BCT) and $BaTi_{1-x}Co_xO_3$ (BTC) thin films with concentrations $x = 0.02, 0.04, 0.08, 0.12, 0.16,$ and 0.20 were synthesized by sol-gel spin coating method on silicon substrates. The crystal structures were studied by XRD, and the magnetic properties were investigated by VSM. Tetragonal structure was observed in each sample except for BMT with $x = 0.02, 0.16,$ and 0.20 . The lattice parameter a increases, while c decreases with increasing concentrations x . The unit cell volume also enhances with higher Mn and Co-doping concentrations. The enhancement is greater in Mn-doped samples, whereas BMT and BCT exhibit larger unit cell volumes comparing to BTM and BTC, respectively. Ferromagnetic behavior is detected in all samples. The saturation magnetization per doping ion decreases with increasing x for BTM, BCT, and BTC. The ferromagnetic exchange interactions are believed to be double exchange $Mn^{3+}-Mn^{4+}$ for Mn-substituted samples, and $Co^{2+}-Co^{3+}$ for Co-substituted samples.

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Structural Study of Cu(II):Gly Solution by X-ray Absorption Spectroscopy

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This experimental work focuses on the investigation of aqueous solutions of copper(II) chloride mixed with glycine. Structural changes of the mixture are probed by X-ray absorption near-edge spectroscopy (XANES) by varying the Cu(II):Gly molar ratios. Moreover, pH is an important parameter to adjust since it influences the formation of the different species present in the Cu(II):Gly solution, affecting thus the structures observed in the XANES spectra. The information on the coordination shells of the metallic center for various ratio of Cu(II):Gly can be extracted by extended X-ray absorption fine structure spectroscopy. This could be a key for the understanding of the interactions of metal ion with biomolecules as a basic knowledge for future applications.

A06: Condense Matter and Accelerator (Poster) / 555

Electronic Band Structures of LiGaO₂ under Pressure: First Principles Study

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Beside the natural phase, LiGaO₂ under different pressure conditions can be stable in different structures [<http://dx.doi.org/10.1016/j.ceramint.2017.05.247>]. The structures of LiGaO₂ were named WZ', HX', BCT', RS' and RS'' in analogous with the well-known phases of ZnO. In this work, the electronic band structures of those phases were studied. We found that the bandgap as well as the bandgap type (direct/indirect) are strongly depend on the crystal structure. In addition, for selected crystal

structures, the changes of the band gaps with respect to the pressure, i.e., the bandgap deformation potentials, were studied. Our results illustrated that the bandgap of LiGaO₂ can be modified by applying pressure in different conditions. The details of the electronic band structures for different phases of LiGaO₂ and the pressure dependence of selected phases will be presented and discussed.

A06: Condense Matter and Accelerator (Poster) / 603

Modeling and simulations of the permanent undulator magnet for generation of MIR-FEL

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This research focuses on computer modeling and magnetic field simulations of a permanent undulator magnet at the Plasma and Beam Physics Research Facility, Chiang Mai University. This undulator magnet will be used for generation of the mid infrared free electron laser (MIR-FEL). It has 40 periods with a period length of 40 mm. The magnetic field can be varied by adjusting a gap of the undulator. A maximum magnetic field of 0.29 Tesla, which corresponds to the undulator parameter of 1.08, can be achieved for the undulator gap of 25 mm. The magnetic field simulations were conducted by using computer programs PANDIRA and RADIA for 2D and 3D modeling, respectively. The simulation results from both models are compared and discussed in this paper. The achievement of this study will be used as a significant information for installation and operation of the undulator magnet at our facility.

A06: Condense Matter and Accelerator (Poster) / 632

Simulations and measurements of the dipole magnet using in the energy spectrometer for 4 MeV electron beam

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A dipole magnet is one of the important components in particle accelerator systems. It can be used to transport a charged particle beam with desired deflecting angle and direction. Moreover, it is often utilized as a part of an energy spectrometer. This research focuses on simulation and measurement of the dipole magnet, which will be used to measure the electron beam energy produced from the 4 MeV RF linear accelerator (linac) for natural rubber vulcanization at the Plasma and Beam Physics Research Facility in Chiang Mai University. The research activities are divided into three main parts. The first part focuses on 3-dimensional simulation of the dipole magnet by using the RADIA program. The three components of the magnetic field (B_x , B_y , B_z) can be derived from the 3D model. The second part is the magnetic field measurements of the magnet after the construction. Then, the simulation and the measurement results are compared. The maximum magnetic field of about 0.2088 mT can be obtained with an excitation current of 3 A. The last part focuses on the electron beam dynamic study by using a program called A Space Charge Tracking Algorithm (ASTRA) to track the particles

through the magnetic field distribution. The simulation data provides 6-dimensional coordinates (x , y , z , p_x , p_y , p_x) of the particles at the desired position downstream the dipole magnet. The results of this research can then be used to design a proper energy measuring system.

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Design of dual flattening filter for 4 MeV electron beam irradiation system

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A 4 MeV electron RF linear accelerator (RF linac) at the Plasma and Beam Physics Research Facility, Chiang Mai University, is used to irradiate electron beam on the natural rubber latex for vulcanization process. The irradiation area and uniformity of electron dose have significantly influence on the vulcanization quality and throughput. This research focuses on design of electron beam flattening filter to enlarge the transverse beam size with more uniform energy and dose distribution. The flattening filter system consists of two different filters. The primary one is used to increase the transverse beam size while the secondary one is used to modify the beam for achieving more uniform transverse distribution. Optimization of the filter system was performed for 4 MeV electron beam by using the GEANT4 Monte Carlo simulation program. The initial electron beam has a pencil shape with 2 mm RMS transverse Gaussian distribution. The optimized parameters of the filters are thickness, shape and position. The results of the optimization suggest that the primary filter should have high atomic number. The tantalum (Ta) sheet with a thickness of 0.3 micron was chosen. The material and shape of the secondary filter were also studied. It is found that the aluminum (Al) plate with special design shape can smear the beam to uniformly distribute over the irradiating area. The output of this work will be used to construct the flattening filter system for the electron beam irradiation system to increase the vulcanization throughput.

A06: Condense Matter and Accelerator (Poster) / 637

Study of the Resonant Cavity for the Low-level RF System at the PBP- CMU Linac Laboratory

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This research aims to investigate the characteristics of the resonant cavity, which is a part of the radio-frequency (RF) power system of the electron linear accelerator (linac) at the PBP-CMU Linac Laboratory, Chiang Mai University. A resonant cavity is used to create RF waves of the desired frequency by exploiting the relation between the cavity dimension and the resonant frequency. The resultant RF wave from the resonant cavity is amplified and used to accelerate electron beam in the linac, that has a specific operating frequency. Simulations of the electric and magnetic field patterns inside the resonant cavity, as well as the resonant frequency, were performed by using the SUPERFISH program. Meanwhile, measurements of the resonant frequency for the real cavity were done with a spectrum analyzer. The relation between the cavity length and the resonant frequency was studied. The data from simulation and measurement are compared. The study results showed

that our resonant cavity has TM_{112} mode and the resonant frequency has a negative linear correlation to the cavity length. This cavity has an inner radius of 6.89 mm. The resonant frequency of the cavity can be varied by adjusted its length. The optimal cavity length, which produces the RF waves of 2856 MHz, obtained from the measurement was 134.8 mm. However, the simulated optimal length is 3.9% shorter than the measured one. This difference is expected to be an effect of antenna coupling, which was unable to avoid in the experimental setup.

A07: Astronomy I (Poster) / 480

Weak Lensing Analysis of the SPIDERS Clusters

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Galaxy clusters are the most massive gravitationally bound systems in the universe. Direct observations and theoretical studies of galaxy clusters reveal important information of large-scale structures. In this study, we use the weak gravitational lensing's analytical technique to investigate the mass distribution in galaxy clusters. We report our preliminary results on the analysis of the SPectroscopic IDentification of ERosita Sources (SPIDERS) clusters, in the redshift range 0.05 – 0.6. We use imaging data obtained from the Dark Energy Camera Legacy Survey (DECaLS) to fit the excess mass density with the Navarro–Frenk–White (NFW) profile. We have stacked the cluster mass profile using the optical richness to measure their average density profiles in each bin to constraint the scaling relation.

Keywords: weak gravitational lensing : galaxy cluster

A07: Astronomy I (Poster) / 481

The study of Jovian magnetospheric plasma using the investigation of satellite footprints brightness

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The magnetosphere of Jupiter could be partly controlled by energetic particles originated from volcanic eruption on Io. These energetic particles could affect the variation of plasma sheet's density, and accordingly the azimuthal current inside magnetosphere. The variation of azimuthal current results in the stretching of magnetic field line of Jupiter. Accordingly, the mapping of Jupiter's aurora and satellites footprint would vary as well. The investigation of brightness of satellite footprints will refer to the structure of Jupiter's magnetic field which varies due to the influence of plasma in magnetodisc region. This work presents a study of Io and Ganymede's footprint brightness in Jupiter's ionosphere. Jupiter's aurora images were obtained by Hubble space Telescope (HST) with Advanced Camera for Surveys (ACS) instrument in 2007. The data were studied using Fourier fitted

technique. From the region around Io, plasmas diffuse outward and take some time to propagate to Ganymede. Thus, the position of satellites are considered with observed footprint brightness time as well. This work found inverse relation between Io's and Ganymede's footprint brightness. Orbits of satellites are found to be significant factors for the variations of satellites' footprints. For example, Ganymede orbit in middle magnetosphere which is affected by the stretching of magnetic field. Therefore, Ganymede's magnetic footprint should be more fluctuated than Io's magnetic footprint. The reason is because Io orbits in inner magnetosphere. In addition, the dense plasma torus and the magnetic anomaly of Jupiter could play important roles in shifted locations of Jupiter's main auroral emission and satellites footprints.

Keyword: satellite footprints, Jupiter's magnetosphere, magnetospheric plasma

A07: Astronomy I (Poster) / 525

Analysis of Structure and Evolution of Binary System GV Leo

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GV Leo is a W Ursa eclipsing binary with an orbital period of 0.266727 day. From the previous investigation of its light curve, it was found that this binary system has a continuous orbital period change. A light curve of GV Leo was analyzed using program MaxIm DL3 and its period change was also calculated. The results revealed that the orbital period of GV Leo was continuously decreased at rate of 0.004524349151 seconds per year to 0.005440856529 seconds per year and using PHOEBE software was used to compute the best system is parameters. The over contact binary system with $g = 0.829$, $i = 69.86$ degree. The temperature of primary star and secondary star were 5,020 K and 5,650 K respectively. From the analysis of physical parameters and model, it was found that GV Leo had a contact characteristic with high mass ratio. It is possible that the evolution of GV Leo would be a single star due to mass transfer of the system.

A07: Astronomy I (Poster) / 557

The observation CV system V2301 Oph by using ULTRASPEC

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In this research, we aim to study an AM Her-type cataclysmic variable (CV) system, V2301 Oph. This eclipsing system has an orbital period of 1.8hrs and it is known to have a white dwarf with the weakest magnetic field ever detected in AM Her systems. The observations of V2301 Oph were obtained with the 2.4-meter reflecting telescope with an alt-azimuth drive system at the Thai National Observatory. The photometric data were collected in g' , r' , and KG5 filters using the ULTRASPEC instrument and the data are then analyzed using the ULTRACAM pipeline. In the current work, we will present the light curves obtained from 2014-2018 where we focused on the primary eclipses of this system. Our goal is to verify the existence of circumbinary planets through accurate analysis of the ingress and the egress of the white dwarf during the eclipse. Our preliminary result show there is an increasing trend in the O-C diagram of V2301 Oph, which indicates that some processes are causing an increase of the orbital period. However, longer monitoring is required to confirm this finding.

A07: Astronomy I (Poster) / 583**Comparison of lunar calendar with lunar phase that calculate from photos of the moon****Author:** Anutida Makmee^{None}**Co-author:** Sathon Vijarnwannaluck**Corresponding Author:** a.nut.i@hotmail.com

The Thai lunar calendar was made from the phase of moon to defined Buddhist days and Thai traditions. The waning moon is caused by a mutual orbit of the earth, the sun and the moon. Lunar phase is ratio of bright area to the total area. The different phase each day makes a cause in the lunar calendar. The moon's synodic period is 29.53059 days but number of days in each month must be integer. Therefore there are two type of Lunar month, the 29 day month (odd number month) and the 30 day month (even number month). We have been using lunar calendar for long time so it has error. This project wants to compare lunar phase calculated from photos of the moon with Thai calendar and that from Stellarium Program. The photos were taken on 7th - 9th , 14th - 15th day before new moon and 1st , 7th - 9th day before full moon in 5th - 7th month of lunar calendar in the year 2017. And more information was collected in 1st - 4th month of the lunar calendar in year 2018. From this, we enlarged the image, made a concentric circle and print the pictures on A4 paper. Next we measured radius and the longest of dark edge for each photo. Then we calculate the lunar phase from data and compared with calendar. The calendars determined that the increase and decrease of lunar phase for each day are constant, reference point is at 6 a.m. on 1st day before new moon at the starting of the month. The result shows this method can find the lunar phase from the photos at 3 decimal places. The lunar phase from the photos and the program are similar and error is linearly independent. When compared lunar phase from photos with the calendar, 9th day before new moon and 7th day before full moon are the most error. While 7th day before new moon, full moon day, 9th before full moon give the error close to zero. The graph error of time is similar the sine function. The error of lunar phase is positive; the lunar phase from photos more than theory. If elongation error is 6 degree, 57% of information isn't in the error range.

A07: Astronomy I (Poster) / 602**Environmental Correction of Neutron Monitor Leader Fractions****Author:** Hannarong Janthaloet¹**Co-authors:** Alejandro Saiz Rivera¹ ; Chanoknan Banglieng² ; David Ruffolo¹ ; Pradiphat Muangha²¹ Mahidol University² National Astronomical Research Institute of Thailand (NARIT)**Corresponding Author:** hannarong.jan@student.mahidol.ac.th

Cosmic rays are high energy particles from space that we can measure by ground-based detectors, including neutron monitors. The leader fraction represents the fraction of the neutron count rate that is not associated with a previous neutron count in the same tube from the same nuclear interaction. The leader fraction includes new and exciting information about the cosmic ray energy distribution. However, environmental factors including atmospheric pressure and water vapor also affect the leader fraction. We have developed methods to correct the leader fraction to remove these environmental effects. Partially supported by Grant RTA5980003 from the Thailand Research Fund.

A07: Astronomy I (Poster) / 610

Study of the physical properties of Largest Stars using the DSLR camera with a small Refracted telescope

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In this study of the physical properties of large stars, information from all five (5) stars were captured by shooting with a DSLR and through the Star Analyser SA-100 grating spectrometer. The observations were performed with a small 152 mm refracting telescope at the rooftop of Building 23, Faculty of Science, Lampang Rajabhat University. The data were then analyzed using the RSpec program in the visible range. It was found that the studied stars had elemental spectral absorption lines as well as the surface temperature of the stars. Sirius was classified in the spectra of the A2V star with a temperature of 8,219 Kelvin. Pollux K0III with a surface temperature of 4,980 kelvins, Aldebaran K5III with a surface temperature of 3,845 Kelvin, Rigel B8I with a surface temperature of 7,603 Kelvin and Betelgeuse M2I with a surface temperature of 3,851 kelvins. These data are consistent with the data of the international standard. This study can be utilized as a basis for low-cost stellar spectroscopy that can be applied in the study of astronomy in schools.

Keywords : Large Stars, Spectrum Type, Chemical Composition, Surface Temperature, Digital Single Lens Reflex

A07: Astronomy I (Poster) / 611

Analysis of the Planetary Atmosphere in the Solar System Using a DSLR Camera

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The planets in the solar system have different characteristics in their atmospheric composition. The atmospheric composition of a planet can tell us the evolution and activities that occur on the planet. In general, to identify planetary atmospheric composition is not common, expensive and utilizes advanced instruments. In this research, we proposed a simple and affordable technique to analyze the atmospheric compounds which can be applicable for small schools or institutes. Remotely luminous points in the night sky can be photographed by a digital single-lens reflex (DSLR) camera which is attached to a grating spectrometer and a small refractor telescope to obtain a spectrum band. The spectrum were analyzed in the absorption bands using RSpec (Real-time Spectroscopy) software. This study selected Mars and Jupiter to analyze the compositions of their atmosphere. The results are as follows: Mars absorbs the spectrum range of Ar, O I, Kr, CH₄ and Ne elements; and Jupiter has absorption spectra of CH₄ and He. These correspond to other standard information.

Keywords : Atmospheric compositions, Digital single lens reflex, Refractor telescope, Absorption spectrum

A07: Astronomy I (Poster) / 629

Estimating the Synodic period of the Moon by Meridian transit Method

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The study about synodic period of the Moon during 1983 – 2030 by Ephemeris. The Moon's transit time at observer's meridian were estimated consequently and can be plotted with Julian date to compare with The transit times of the sun in the same graph, therefore the difference between two intersected points were estimated to each Synodic period of the Moon. The result was shown that there were 594 number of synodic period in 1983-2030 and tended to distribute like "Beats" phenomena.

A07: Astronomy I (Poster) / 668

The solar flare analysis on the during of 23rd and 24th solar cycle

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Abstract. This research compiles and analyses information of solar flares data and variation of the actual space environment data from spacecraft for studying the concordances of the variation solar cycle. These information are the specifically solar flare events of X and M class in 23rd and 24th solar cycles. The number of X class flares of 23rd solar cycle more than 24th solar cycle. We found the highest X class flare of X28 on November 4th, 2003 for 23rd solar cycle, and The highest X class flare of X9.3 on September 9th, 2017. The highest solar wind velocity for these both solar cycles are 1020.9 and 750.6 km/s, respectively. The Kp index is an excellent indicator of disturbances in the Earth's magnetic field for solar flares of 23rd solar cycle more than 24th solar cycle. We found the most of solar events in 23th solar cycle occur in southern part of the Sun and the most of solar events in 24th solar cycle occur in northern, which that corresponded to the reverse of the Sun's magnetic field for every 11 years. Overview: the violent of the solar flare events on the 23rd solar cycle higher than 24th solar cycle.

A07: Astronomy I (Poster) / 689

Characterization of Siliceous Sinter From Pong Duet Pa Pae Hot Spring : an Analogue to Early Earth and Mars Environments

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Siliceous sinter from several terrestrial hot springs have been identified as analogues to nearly pure opaline silica deposits, which were discovered at Columbia Hills, Mars by the rover 'Spirit'. On Earth, mineralized microbes and silica conjointly accumulate and build up over time to produce microstromatolites, analogue to predominant structures in early Earth paleoenvironments. Here we collected

siliceous sinter and silicified microbial mats from Pong Dueat Pa Pae, an alkali, mid-to-high temperature hot spring in northern Thailand, and identified the morphological, mineralogical and biological characterizations. SEM results revealed different levels of microbial silicification within the sinter. Mineralogy of the sinter, examined using X-ray Diffraction (XRD), energy dispersive spectroscopy (EDS) and Fourier-transform infrared spectroscopy (FTIR) techniques, which confirmed the presence of amorphous silica (Opal-A), showed to be closely resemble Martian-analogous siliceous sinter from other terrestrial hot springs, such as Yellowstone National Park (USA) and El Tatio (Chile). This study is a pilot work on investigating species of extremophiles in terrestrial siliceous hot springs, including the process of silicification which could provide better understandings of biosignature preservation and narrow down possible candidates for the Mars 2020's seeking sign of past life mission.

A07: Astronomy I (Poster) / 732

Initial Galaxy Model of NGC 5252

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We present initial condition galaxy model of NGC 5252, which galaxy has black hole, gas particles, dark matter halo particles and bulge particles. This model uses Navarro–Frenk–White (NFW) profile and Sersic profile for describes distribution of particles. NFW profile describes profile of dark matter. In another way, Sersic profile describes how the surface brightness of a system varies with distance from the center, which sersic index = 5.18. Finally, this initial condition galaxy model can used to study kinetic feedback from active galactic nuclei (AGN) and galaxy evolution.

A07: Astronomy I (Poster) / 760

Substorm onset determination based on POLAR/VIS and POLAR/UVI observations

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Earth auroral phases, growth, expansion, and recovery phases, are the signatures of Earth's substorm event in the polar regions. Auroral emissions in Earth's northern hemisphere were observed in November 6, 1998, by the Visible Imaging System (VIS) the Ultraviolet Imager (UVI), instruments onboard POLAR spacecraft. Auroral morphology during 8:00UT – 9:00UT was studied based on images taken by several filters, giving the variations of the emission in different wavelengths, for VIS; 557.7, 130.4, 391.4, 630.0 nm and for UVI; 130.4, 135.6, 150, and 170 nm. In addition, the time series plot of integrated auroral flux at magnetic latitude between 60-65 degrees and magnetic local time between 22.0-1.0 hr was used to assist the determination of onset time. Base on the combination of analysis on 2D images from several filters, the bright emission was seen to extend westward from the initial brightening between 08:34:29.5 UT and 08:35:32 UT, which is indicated as the beginning of the expansion phase. From time series plot, this behavior was clearly seen as the brightening of integrated photon flux of wavelength 557.7 nm. This onset time determination will further assist the investigations of auroral behavior, in corresponding to other observations, e.g., magnetic field and particle measurements.

A07: Astronomy I (Poster) / 778

The Expanded Planet Radius Model in XUV-region by Rayleigh Scattering on HD209458b

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The short-period Hot Jupiter such as HD209458b has been speculated that the expansion of its atmosphere due to intense irradiation from its host star with close orbital distance might exist. Several observational evidences have shown that the planetary radius is relatively larger in shorter wavelengths with respect to optical wavelength by transit observation. It may imply that the planetary radius can expand in high-energy wavelengths due to Ly α absorption of HI-rich atmosphere, which is the key factor to tremendous outflow of atmospheric gas, in order words, the atmospheric mass loss. However, the expanded planetary radii in UV and X-ray region in observation are still controversial because of their high uncertainty when compared to visible region. In this literature, we will demonstrate the expanded planetary radius model with continuum spectrum by Rayleigh Scattering process, especially in X-ray & extreme ultraviolet (XUV) wavelength region, in order to assure that the estimation of atmospheric mass loss rate from XUV-absorption in this planet is approximately 10^{10} g/s, and the expansion of planetary radius is significantly reliant on the shorter wavelength flux's absorption by its atmosphere.

A07: Astronomy I (Poster) / 780

Study of cosmic-ray spectrum using gamma-ray data from Fermi Large Area Telescope

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Cosmic rays (CRs) are high energy particles in space, mainly protons, for which the spectrum is well described by a power law. Recent measurements from PAMELA and AMS-02 indicate an abrupt change of the CR proton spectral index at ~ 300 GeV. When CRs interact with the Earth's upper atmosphere, gamma-ray (γ -ray) photons can be produced and detected by space-based detectors. We use the Earth's γ -ray data observed by the *Fermi* Large Area Telescope (*Fermi*-LAT) along with proton-air interaction model perform Monte Carlo simulation and determine the CR proton spectral indices that best fit the γ -ray data.

A07: Astronomy I (Poster) / 783

Solving super diffusion problem in stretched isotropic simulation by box length adjustment

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Magnetic field line random walk (FLRW) are a resultant from the turbulence of particle and internal magnetic field lines in the interplanetary medium. When high energy particles passing through the

medium, their trajectories will be bended following a magnetic FLRW behavior according to the 2D and slab model. The isotropic turbulence simulation which depends on the stretched parameter α , is used to explain this model. However, the magnetic field lines is changing to super diffusion state at $\alpha = 0.025$, 0.05, 0.1, and 0.25. This problem may occur from the magnetic FLRW moving over a simulated condition or known as periodicity. In this study, the isotropic turbulence simulation was improved by adjusting the simulated boundary for observing the magnetic FLRW behavior and also studied with varying mean magnetic field. Then the diffusion coefficients were calculated to compare a result with the accepted theories. The results show that the diffusion coefficients can be calculated to explain the behavior of magnetic FLRW in the isotropic turbulence simulation, excepting for the mean magnetic field of 0.5 and 1 which need to be studied under several different conditions.

Keywords : Random walk behavior, Magnetic field line random walk, Isotropic turbulence, Super diffuse, Periodicity, Diffusion coefficient

A08: Instrument (Poster) / 785

A Particle Detection Modeling of Non-contact Coplanar Differential Impedance Sensor in Microfluidic System

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Over the last few years, study of microfluidic flow cytometry using electrical signals has developed at a fast pace. There are several electrical detection configurations but differential impedance sensing offers a greater advantage due to its capability of cancelling common noise from the detected signal, resulting in improved signal to noise ratio. This paper presents the simulation of a differential impedance sensor by employing the finite element method to gain an insight and to find the proper range of the working excitation frequency for the detection system. A polystyrene microbead was used as a model particle flowing past the detection area that had non-contact excitation and two pickup coplanar electrodes in which an excitation electrode was positioned between the two pickup electrodes. The modeling results showed that for a 2 μm PDMS separation layer, the range of optimal excitation frequency was about 100 - 1000 Hz when DI water was a background medium. The bead size to microchannel height ratio was found to affect the sensitivity of detection, in which the closer the height ratio was to the unity ratio, the more current was detected. The results of the simulation study will be used in fabricating an actual device for microfluidic particle cytometry applications.

A08: Instrument (Poster) / 645

Development of Temperature Equipment base on Pt100 Sensor for Gauge Block Calibration Process

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We developed the temperature measurement for use in the process of calibrate gauge block. The measurement equipment sense the temperature by four Pt100 temperature sensor. This sensors are very small in size and can contact with not affect the gauge block temperature. The small size sensors ability to measure the temperature of tiny piece or a big size gauge block. This temperature equipment organize by Arduino microcontroller board with high resolution MCP 3424 analog to digital convertor 18 bit. The Arduino calculated the voltage converted from MCP3424 to temperature by the Ohm law. Four Pt100 got the current about 1 mA to generate the voltage across. With this develop measurement, we have the temperature equipment that can measure temperature with resolution 0.04 °C and test this equipment at ice point. We got the average temperature along 83 minutes of four Pt100 equal 0.14 °C, 0.14 °C, 0.16 °C and 0.13 °C. The all standard deviations of measurement temperature are in the range of calculated uncertainties.

A08: Instrument (Poster) / 646

The collection and identification of gunshot residues to distinguishing 4 types of bullets by inductively coupled plasma mass spectrometry

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The identification of gunshot residue (GSR) dispersed in a shooting is important for forensic evidence to solve the firearm shooting crimes. In this experimental study, the residue of specific elements, namely: Lead (Pb), Antimony (Sb) and Barium (Ba) were compared using inductively coupled plasma mass spectroscopy from 4 types of 9 mm. ammunition labeled as A is Lead Round Nose (LRN) 135 gr., B is Jacketed Hollow Point (JHP) 115 gr., C is Full Metal Jacketed (FMJ) 124 gr. all of Bullet Master and D is Full Metal Jacketed (FMJ) of Thai Arms. The Bullet holes from wooden and metal targets at 7 firing ranges; 0.00, 0.15, 1.00, 1.50, 2.00 and 2.50 meters were investigated by cotton swab dripped with 5% nitric acid. The analytical results showed that at the firing range of 0.00 meters, very high concentrations of Pb was found more than Sb and Ba, while the outer side of the hole found more amount of the elements than the inner side. Moreover, the results shown the amount of Pb, Sb, and Ba of ammunition A (LRN), B (FMJ) and C (JHP) of Bullet Master are significant difference, and classify the ammunition C (FMJ) of Bullet Master from the ammunition D (FMJ) of Thai Arms using Pb and Sb concentration. From the results of this study can be useful scientific evidence for forensic science investigation in order to estimate the ammunition and firing distances.

A08: Instrument (Poster) / 661

Exploring pomelo for its electrical capacitance with parallel plates

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Pomelo is a tropical fruit that is widely cultivated in Thailand. The price is largely varied according to cultivars. Certain qualities can be observed from fruit exocarp but for fruit sweetness or sourness it is impossible to externally determine. In this work, we explore the relation between the electrical capacitance and the fruit pericarp using a parallel-plate system for four frequencies, 2, 10, 50, and 100 kHz. Fifteen pomelos are measured for their capacitance, weight, and physical dimensions. The same measurements are repeated for all samples without their exocarp and mesocarp. The results show that the capacitance decreases when exocarp and mesocarp are removed. The decrement is due to the loss of water molecules residing in the pericarp. As a consequence, its permittivity declines.

The ratio of capacitance to fruit mass displays variation that is possibly related to soluble solid and chemicals in the fruit.

A08: Instrument (Poster) / 674

Simulation and design of automatic microwave heating system for studying effect of microwave on quality of crude palm oil

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In the small-scale palm mill industries, the processes have produced low quality crude palm oil. The oils have high free fatty acid content (FFA > 5) and low Deterioration of Bleachability Index (DOBI < 2), which are classified as grade B oils. Since, they used hot air for too long time in pre-treatment process. In this research, microwave will be used as heating source for pretreatment, to shock the fresh palm fruits by rapidly increasing the temperature. The microwave heating can inhibit the action of lipase in the reaction oxidation to decrease FFA content. At the same time microwave heating will melt crude palm oil in mesocarp, that resulting in DOBI increasing. To develop microwave heating system, microwave propagation in waveguide and cavity are simulated, therefore optimum dimensions of cavity and positions of waveguide installation were obtained. At the optimum conditions the electric intensities of 2.45 GHz microwaves are strongest at position of palm fruit placement. The optimum dimension of the cavity is 33 cm x 33 cm x 33 cm.

A08: Instrument (Poster) / 687

The generated electrical signal of piezoelectric sensor by a single pulse

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The objective of this study was to study the generated electrical signal of piezoelectric sensors patched on the various samples by using one single pulse. Piezoelectric sensors used in this study were the commercial piezoelectric buzzers which are PZT ceramic disk of 20 mm with brass plate of 27 mm in diameter. The generated electrical signals of piezoelectric sensors from aluminum plate, acrylic plate and wood plate were compared in this study. The experimental result is expected to explain physical mechanism for structural health monitoring application.

A08: Instrument (Poster) / 701

The controller and monitoring system of 1-10 kV high voltage power supply

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The controller and monitoring system of 1-10 kV high voltage power supply was developed. The system composed of an Arduino mega 2560 microcontroller boards, a digital to analog conversion (DAC) part, a high voltage module and the designed software on a personal computer. The software was developed by LabVIEW software for controlled the high voltage module and displayed the high voltage values. The microcontroller board used for the digital data transmission to the DAC part and converted the high voltage value to digital data for monitoring. The DAC part generated the analog signal from a board for adjusting a high voltage value of a module. The completed system can be controlled the high voltage and the real-time monitored the high voltage value of a module with the resolution of 2.5 V. The error of actual high voltage values with the setting one was maximum of 5%.

A08: Instrument (Poster) / 722

Development DC Plasma Torch for High-temperature Processing

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In this work, the 5 kW DC plasma torch system has been developed which is composed of the DC power supply unit and plasma torch head. The power supply unit provides the DC current up to 50 A, 5 kW. The plasma torch head is concentric type, whose cathode electrode is in the center of hollow cylindrical anode electrode. The anode is 10 cm long and its inner diameter is 5 mm. The gap between both electrodes is 3 mm. When the 0.5 MPa compressed air has been applied to the head and the 50 A, 90 V DC current has been supplied, the thermal plasma torch has been generated. The torch is 10 cm long and its diameter is 1 cm wide. The knowledge of this work will be used for up scaling the system to be suitable for disposal of infectious wastes.

A08: Instrument (Poster) / 731

Development of the PID controller and real-time monitoring system for a low-temperature furnace

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The PID controller and real-time monitoring system for a low-temperature furnace was developed. The system has two part, the PID controller, and the real-time monitoring part. An Arduino mega2560 microcontroller board was used for measuring and control the furnace temperature. A type-K thermocouple and a MAX31850 IC was applied for a furnace temperature measurement. The microcontroller board and a MAX31850 were connected via the One-wire bus for convert the temperature values and sent to a personal computer. The PID parameters can be varied by a user in the program, which developed by LabVIEW Software on a computer. The laboratory made furnace was established for testing the controller and monitoring system. The results have shown that the temperature with the range of 25-500 degree Celsius can be controlled. By the trial and error method with the PID parameters, k_p was 250, T_i was 0.05 and T_d was 0.20, the target temperature can be controlled with the maximum error of 1 degree Celsius.

A08: Instrument (Poster) / 734

TRIBOLOGICAL CHARACTERIZATION OF ELECTRONIC GRADE LUBRICANTS USING BALL-ON-DISK TRIBOMETER

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In microelectronic industry, the lubricants are used in the wafer-to-chip grinding and lapping processes before device assembly step. The based-lubricant and additives play important roles in the product quality and reliability for those nano-scale fabrications. In this study, the tribological behaviors of AlTiC surface that sliding against AISI304 balls were studied in electronic-grade ethylene glycol (EG) based lubricants by using ball-on-disk Tribometer. The friction force and coefficient of friction (COF) of different lubricants are measured and calculated. Our results show that the COF depends on many factors such as types of lubricants, load and sliding speed. The different additives in lubricant also affect the friction force. Moreover, there is a model of a power law in ice friction which can be explained the relationship among tribological parameters. It was applied to explain the lubricant behavior and lubricant state in this study

A08: Instrument (Poster) / 742

Light Curve Analysis and System Parameters of Contact Binary V608 Cassiopeiae

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A new photometric data study of eclipsing binary system are presented. The accepted solutions of analyzing the light curve revealed that V608 Cassiopeiae is a contact binary with two solar-type spectra component. The primary component of this system is the massive one. The geometric configuration indicates that each component of V608 Cas exactly fills its limited Roche lobe and mass overflows outside of the lobe, which makes it common envelope. New epoch, the primary and secondary minimum and the absolute physical parameters of the contact binary system were calculated. The evolution status of contact binary V608 Cas has been investigated.

A08: Instrument (Poster) / 749

Development of the low cost hot plate temperature controller using Arduino Uno R3.

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The low-cost hot plate temperature controller was developed using Arduino Uno R3 microcontroller board. The controller composed of the Arduino microcontroller which was the controller main part, a temperature sensor part and a 7-displays part for monitoring temperature values. The K-type thermocouple connected to MAX31850 IC was established for a temperature sensor. The 4-digit 7 segment display was used for temperature monitoring. The controller program consists of measurement, display and controls the PID parameters was developed in Arduino IDE. The hot plate which has 24-ohm heater wire was applied to this experiment. The result has shown that the temperature

in the range of 25-500 degree Celsius was controlled with the resolution of 0.25 degree Celsius. Using the trial and error method for the PID parameter varied the target temperature can be reached with the maximum error was 3 degree Celsius.

A08: Instrument (Poster) / 754

Directivity of a Thai Low-pitched Bowed String-instrument, Saw-U

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To preserve good quality of a musical instrument, a study of its acoustic property is very crucial. In this study, the directivity of a Thai Low-pitched Bowed String-instrument, so-called Saw-U, made by a renowned Thai musical instrument manufacturer is studied. The directivity is also quite important for other acoustical utilization, such as architectural acoustics and auralisation (e.g. sound field simulation). The aim of this study is to measure and analyze the directivity patterns and characteristics of this instrument, as well as preserve and pass on its quality. The measurement was carried out on the saw-u performed by a professional music player in an anechoic chamber. The results show that the saw-u has a unique directional characteristics.

A08: Instrument (Poster) / 773

Design and Construction of Torque Magnetometer for Magnetic Properties Investigation

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In this research, cantilever based torque magnetometer was designed and built for investigation of magnetic properties of materials. Torque on magnetic moment of the sample was detected by the torsion and flexion of the cantilever. The laser beam deflected from the sample platform was detected by a quadrant photodiode. The system can be used to measure anisotropy direction of a permanent magnet. By using these technique, external field and magnetic dipole moment of the sample does not affect its anisotropy direction.

A08: Instrument (Poster) / 781

Measurement of sound absorption coefficients for panels made of rice straw, pine leaves, and grey sedge

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Sound pollution has long been known to inflict problems to both humans and animals. Judging sound to be pollution does depend on situation. Typical protections come in many forms according to specific problem. Sound absorber is one of those forms playing an important role in reducing reverberating effect in rooms or auditoriums. General commercial absorbers are constructed from mineral wool or asbestos That are harmful to respiration system. Therefore, natural materials become of interest. In this work, we use an impedance tube to determine the sound absorption coefficient of natural materials—rice straw, pine leaves, and grey sedge. The specimens are dried and mixed to certain ratios forming 6-cm diameter disk panels with the thickness of 1.5 cm using powder glue as binder. The measurement is based on ISO 10534-2 standard and covers the frequency range of 400-2500 Hz with backspacing of 0, 10, 20, 30 mm. It is found that the sound absorption coefficient of dried grey sedge shows the strongest absorption of ~0.99 at 500 Hz with the backspacing of 30 mm while that without smacking also display strong absorption, 0.8, at 1500 Hz. For the absorption of dried rice straw, the results indicate that without space behind the sample the absorption is strongest, ~0.96, at 2258 Hz while other spacings provide the value of ~0.85 for lower frequencies. Finally, the pine-leaf panel yields weakest absorption of no more than 0.8 comparing to those of other materials. We can see that these natural materials if properly prepared can perform as sound absorbers.

A08: Instrument (Poster) / 790

Detecting concentration of Bilirubin in the neonates by using absorption of light

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Hemolytic disease of the newborn or erythroblastosis fetalis occurs when there is an incompatibility between the blood types of the mother and baby. In this condition, red blood cells of the newborn are broken down and destroyed (hemolysis). When the red blood cells break down, a substance called bilirubin is formed. The Bilirubin has a pigment or coloring, it causes a yellowing of the baby's skin and tissues. This is called hyperbilirubinemia. The hyperbilirubinemia reflects is a normal phenomenon for infants. However, in some infants, bilirubin levels may rise excessively, which is very dangerous and immediately requires medical attention. because this disease can cause seizures, brain damage, deafness, and death. For these reasons, the presence of neonatal jaundice frequently results in diagnostic evaluation. The objective of this research is to develop test kit for detecting concentration of Bilirubin by using absorption of light. This work is separated into 2 parts. In the first parts, choosing filter paper that could absorb the plasma to clearly show bilirubin was studied. We found that the paper - MF1 is the best filter paper to use in our test kit. The second part, finding relation between concentration of bilirubin and absorbing RGB values by programming RGB color sensor and assembling microcontroller devices were explored. We found that the relation between concentration of standard Bilirubin solution and the B value can be fitted with equation as $y = 13.7\ln(x) + 9.356$ which x is the concentration of Bilirubin and y is B value. Besides, our device can detect the concentration of Bilirubin in range of 0-10 mg/dl.

A08: Instrument (Poster) / 503

Sensitive layer and charge collection optimization of MAPS for the ALICE ITS upgrade

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For the long shutdown of the LHC in 2019, Monolithic Active Pixel Sensors (MAPS) are being studied to use for the Inner Tracking System of ALICE detector. The pixel chips, manufactured by the TowerJazz with 180 nm CMOS imaging sensor process, have been characterized to produce the new sensor with lower material budget and higher granularity. The optimization of the pixel is determined from different pixel pitches, the collection electrode size, the distance between the electrode and the surrounding electronics and the reverse bias voltage on the collection diode for the performance of pixel chip by using of ⁵⁵Fe X-ray source. In this work the optimization of the pixel sensor for the sensitive layer and the charge collection electrode will be presented.

A08: Instrument (Poster) / 528

Grazing Incident X-Ray Diffraction using Synchrotron Light at SLRI

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This work demonstrates the capability of the BL7.2W:MX diffraction beamline at SLRI for investigation of crystallinity of nano-films. The beamline utilizes hard X-rays from a 6.5-Tesla Superconducting Wavelength Shifter, originally designed for protein crystallography. Its x-ray optical beamline employs a collimating mirror, double-crystal monochromator and focusing mirror. The photon energy can be chosen between 7 to 18 keV with a photon flux of more than 1010 photons/sec at 100mA stored electron beam. The X-ray beam size can be reduced to 20 micron, allowing X-ray diffraction (XRD) measurements with grazing geometry. The description of the synchrotron beamline and grazing incidence XRD (GIXRD) setup will be given with commissioning results. The advantages of synchrotron GIXRD will also be demonstrated in this work.

A08: Instrument (Poster) / 558

Studies on the Possibility of Determination of Uranium and Thorium Concentration in the Thai Monazite Ore Processing Samples Using Gamma-ray Spectrometry Technique

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The possibility of the determination of U and Th concentration in the Thai monazite ore processing samples using gamma-ray spectrometry technique was investigated. The studied samples were monazite ore, tri-sodium phosphate, mixed rare earth hydroxide, enriched cerium, uranium cake, thorium cake, La₂O₃ and CeO₂. The measured activity concentrations of ²³⁸U and ²³²Th were converted into the concentrations of U and Th under the assumption of secular equilibrium. The results showed that the major daughter nuclides found in the studied samples, were ²¹⁴Pb ²¹⁴Bi and ²²⁶Ra for ²³⁸U series with additional radionuclides of ²²⁸Ac, ²¹²Pb, ²⁰⁸Tl and ²¹²Bi for ²³²Th series. The concentrations of U and Th estimated via each daughter products of their series were not significantly different for all samples. Wavelength Dispersive X-ray Fluorescence (WDXRF) with different sample preparations (loose powder, pressed pellet and fused bead methods) was also used to determine the concentrations of both U and Th in these samples. A good agreement between the concentration of U and Th measured by gamma-ray spectrometry (U = 0.42 wt%, Th = 6.54) and WDXRF prepared by fused bead method (U = 0.41 wt%, Th = 7.37) was observed for monazite ore sample.

A08: Instrument (Poster) / 559

Elemental and Chemical Analyses of Low Quality Mogok Ruby

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It is well-known that high quality gem stones are naturally rare. Thus, lots of effort have been spent to improve low quality gem materials to enhance their appearances. This work focuses on the characterizations of low quality Mogok ruby to provide the information for improving its color. UV-Vis spectroscopic, X-ray fluorescence spectroscopic and X-ray absorption spectroscopic techniques were employed to obtain elemental and chemical information of the ruby. The measurement results will be presented and discussed.

Keywords: ruby; XRF; XAS; UV-Vis

A08: Instrument (Poster) / 562

Uncertainty Estimation of pH Measurement by ISFET sensor

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We examine the uncertainty of pH measurement by an Ion Sensitive Field-Effect Transistor, or ISFET. Due to its size and ability to simply integrated to measurement electronics, the sensor is suitable for pH measurement on the field. However, the uncontrolled environment can interfere the accuracy of the measurement. In this work we consider a mathematical model of pH measurement that involves

the effects of measurement environment, focusing on light and temperature, together with standard uncertainty sources on the sensor. We calculate the average responses of the sensor (Volt/pH unit). In the dark environment, the responses increase slightly with temperatures. We also calculate the temperature coefficient, which can be used to correct the temperature-dependent of the measured pH. With the light, the responses fluctuates and the temperature coefficient cannot be calculated. These results suggest us that the measurement should be perform in the dark. The uncertainty of pH varies with the temperature, and has minimum value about ± 0.03 , obtained at 25°C.

A08: Instrument (Poster) / 579

Quadcopter flight controlled by microcontroller

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In this project, quadcopter flight controller using microcontroller Arduino UNO R3 was built. The microcontroller Arduino UNO R3 is used because it can receive both digital and analog signals, there are several receive and output ports which can send PWM signal which is very useful for control brushless motors using PID algorithm that can govern such high rotational speed. The proposed quadcopter design utilize MEMS (Micro-Electro Mechanical Systems) sensor for measuring physical parameters such as 3-axis acceleration, gyro rate in order for feedback control. As a result, using the microcontroller with proposed algorithm one can control the quadcopter using RF remote control.

A08: Instrument (Poster) / 608

Measuring porosity with air displacement volume

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One of the key factors governing the sound absorption property of material is porosity. It provides localisation of acoustic energy and also dissipates the energy. To predict the acoustic absorbing potential of material, it is essential to determine its porosity. In this work, we present the use of air displacement volume and the concept of energy conservation to determine material porosity. The system consists of two connected identical chambers. The measurement is based on the pressure difference between the two chambers that is initially isolated by a ball valve. One of the chamber is vacuumed to a certain pressure whereas the other chamber with test sample is left at atmospheric pressure. Upon the measurement, the sample chamber is excluded from the surroundings by an acrylic plate. Then chambers are open to one another, causing air flow and pressure rise in the vacuumed chamber. The pressure rise together with energy conservation allows us to calculate the porosity of the sample with the accuracy of ~1.3%. It was also found that the accuracy can be improved by reducing the volume of the vacuumed chamber.

A08: Instrument (Poster) / 635

Contrivance and Modification of In-house Brinell Hardness Tester for BHN Determination of Soft Materials

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The aim of this work was to design and invent Brinell hardness testing machine for in-house testing and used for evaluation of hardness properties of soft materials. In this representation, the coated-wood-free (CWF) paper with grammage at 300 grams were used as the sample, whereas, the indenter diameter and the dwell time of imprinting were used at 7.86 mm and 10 seconds, respectively. After that, the hardness values were determined by using the principle of Brinell Hardness Number (BHN). This report presented the mean and the deviation of quantification that measured by this equipment and the focused parameter were included active weight loading, imprinted diameter, and BHN, respectively. Finally, the consequences of this analysis were discussed for development of this apparatus.

A12: High Energy Physics / 500

A Study of Silicon Wafer with SRP Technique

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Silicon sensors are used for particle tracking in many high energy physics (HEP) experiments. Suranaree University of Technology (SUT), Thai Micro Electronic Center (TMEC) and A Large Ion Collider Experiment (ALICE) collaborate to develop a new sensor for the Inner Tracking System (ITS). In this project, the new sensor is requested to be 50 microns thick to reduce its material budget. To achieve the required specifications, ultrathin silicon wafers with 25 microns thickness and high resistivity are used. We measure the doping concentration and epitaxial layer depth using Spreading Resistance Profiling (SRP) and Scanning Electron Microscope (SEM). Our results show that it is possible to obtain high resistivity wafers up to 1.6 k Ω -cm with an epitaxial layer of 25 microns to be used as starting materials for the new ALICE P ℓ xel DEtector (ALPIDE) sensor.

A12: High Energy Physics / 752

Neutrino spectrum in $SU(3)_\ell \times SU(3)_E$ gauged lepton flavor model

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Massive neutrino is a clear evidence of new physics beyond the Standard Model. One of a well motivated new physics scenario is a model with gauged lepton flavor symmetry. We investigate neutrino properties in the minimal $SU(3)_\ell \times SU(3)_E$ gauged lepton flavor model. In this model, three new species of fermions are introduced to cancel gauge anomalies. These new fermions lead to a see-saw mechanism for neutrino mass generation. We impose the positivity of gauge boson masses and the perturbative unitarity in 2-2 scattering processes constraints to obtain viable neutrino spectrum.

A12: High Energy Physics / 538

Neutrino-Dark Matter Interaction and Bent Seesaw models

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Neutrinos from the standard model of particle physics are massless. However, there have been evidences of the neutrino oscillation indicating that some neutrinos possess tiny but non-zero masses. To describe this phenomenon, new physics at a higher scale, such as seesaw mechanism, is required. The beyond standard model behavior of neutrinos also coincides remarkably with the presence of the dark matter. In this talk, we are exploring possible connections between dark matter and neutrinos in the context of bent seesaw models. Motivating from dark matter constraints, we study a class of models which include 2 fermion singlets and a new scalar field. The standard model-like left-handed neutrinos obtain their masses from seesaw mechanism with the additional fermions. Whereas the additional scalar field is responsible for generating mass for the heavy fermions via symmetry breaking effects. The possible candidates of dark matter from the model will be discussed. Dark matter originated from the neutrino sector also allows us to derive limits on relevant parameters space from experiments such as ICECUBE and KamLAND. Some preliminary results on such limits will be presented.

Keywords: Dark matter, neutrino, seesaw mechanism, dark matter annihilation, particle physics, cosmology

A12: High Energy Physics / 537

Uncertainty Quantification of Hypertriton Binding Energy

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We use the Hypernuclear No-Core Shell Model to study the sensitivity of the hypertriton binding energy to uncertainties in the nucleon-nucleon interaction. Our three-body calculations are performed in the relative Jacobi-coordinate harmonic oscillator basis. In our calculation, we use the leading-order chiral hyperon nucleon (YN) interaction and chiral next-to-next-to-leading-order nucleon-nucleon interactions (NNLOsim). We predict the hypertriton binding energy using this family of 42 NNLO potentials. We find that systematic uncertainties is small for $E(^3\text{H})$. Experimental binding energy is also within our theoretical predictions. Based on our finding of small sensitivity of hypertriton binding energy to NN interaction uncertainties, we claim that it opens up the opportunity to use this bound state observable to constrain the YN interaction.

A12: High Energy Physics / 499

Search for the top squark pair production with two-body decays to a charm quark and a neutralino in proton-proton collisions at $s = \sqrt{13}$ TeV

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The hadronic products that result from proton-proton collisions at the Large Hadron Collider (LHC) can give rise to jet formation that can be detected by the Compact Muon Solenoid (CMS) detector. The new algorithm is developed to identify charm quark jets while rejecting bottom and light flavor jets called c-tagger. The c-tagger is integrated into the CMS software (CMSSW). It can be used in supersymmetry (SUSY) searches for new particles such as stop, the SUSY partner of standard model (SM) top, that may subsequently decay to a charm quark and the lightest supersymmetric particle (LSP) or neutralino.

This talk presents a search for direct production of top squark pairs in proton-proton collisions at a center-of-mass energy of $s = \sqrt{13}$ TeV collected by the CMS experiment at the LHC in 2016. The data used correspond to an integrated luminosity of 36 fb^{-1} . No statistically significant excess of events is found beyond the expected contribution from standard model processes. Exclusion limits are set in the context of simplified models of top-squark pair production. Top squarks with masses below 510 GeV are excluded if the mass difference to the lightest neutralino is small.

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Charm Quark Equilibration at Ultrarelativistic Energies

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At ultrarelativistic heavy-ion collisions, a new state of matter, the quark-gluon plasma (QGP) is created. For highest collision energies, recent lattice QCD data provide the opportunity to explore Charm quark equilibration in the early QGP phase. We propose a new method to determine the Charm quark equilibration temperature and volume from second and fourth order net-Charm susceptibilities together with experimentally measured multiplicity fluctuations. Furthermore, we present first perturbative results for the second and fourth order Charm quark susceptibilities and their ratio.

A12: High Energy Physics / 479

Exploring one loop amplitude at four-point vertices by the OPP method

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We construct the general formula of one-loop amplitude at four-point vertices using Ossola, Papadopoulos, and Pittau (OPP) method. The incoming and outgoing particles are defined as arbitrary massless particles, and the intermediate state contains arbitrary particles inside. In this works, the amplitude is reconstructed via finding four-type rational coefficients. First, box coefficient is extracted using the four-cut technique with linear algebra. We found that triangle and bubble coefficients can be extracted using three-cut and two-cut technique with Cauchy's residue theorem instead of with discrete Fourier sum like the original version of the OPP. Tadpole coefficient can be dropped out, because its scalar integral, which contains only UV divergence, is completely absorbed by renormalization.

A12: High Energy Physics / 466

Entropy Production at the Chiral Phase Transition

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We propose an increased entropy production as a characteristic signal for a first-order chiral phase transition to be observed in heavy-ion collisions. Assuming a simple Bjorken description for the central region of the produced fireball, we study the evolution of the expanding medium using a spatially homogeneous fluid and a time-dependent order parameter σ . We solve the equation of motion for σ coupled to the equations of Bjorken hydrodynamics to describe evolutions through the first-order phase transition, critical endpoint, and crossover region of the linear sigma model. We observe an increase of the total entropy of roughly 10-20% around the phase transition, which is larger for a first-order transition than for a continuous crossover or critical endpoint. Relating the entropy to the number of produced particles, we suggest to search for an increase in pion multiplicity at the upcoming FAIR facility.

A12: High Energy Physics / 465

The effect of nuclear equation of state on the direct flow in heavy ion collision reaction by using quantum molecular dynamics model

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This work concentrated on the effect of nuclear equation of state on the direct flow (v_1) in heavy ion collision reaction by using the quantum molecular dynamics (QMD) model. In addition, the proton

direct flow is a function of the centrality transverse component t of the 4-velocity at incident energy 0.09 A GeV and impact parameter between 0.25 and 0.45 fm by using the nuclear equation of state (soft and hard EoS), which is computed and compared with FOPI experiments. The calculated results show that the proton direct flow as a function of ut_0 is dependent appreciably upon the nuclear equation of state (EoS). The proton direct flow as a function of ut_0 is calculated with soft EoS that is consistent with the experimental data and the nuclear equation of state this can describe the behavior of matter in high density and high pressure in soft EoS, whereas the discrepancy between the results obtained with hard EoS and experimental data goes up by increasing the centrality transverse component t of the 4-velocity.

A12: High Energy Physics / 446

Mass-radius bounds in massive gravity models

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The mass-radius ratio bounds of spherically symmetric static compact objects were considered in the ghost-free dRGT massive gravity. In this type of modified general relativity, the graviton has a non-zero mass leading to the naturally generated cosmological constant term. Therefore, this may bring about to an explanation for the late-time accelerated expansion of the Universe without any dark energy. The hydrostatic equilibrium (TOV) equation in this theory was derived to describe the structure of a spherical object such a star. In this work, the generalized Buchdahl inequalities, providing the upper and lower limits of mass-radius ratio for high density compact objects, were obtained together with their crucial constraints. Finally, for theoretical testing these results may be proved in the context of astrophysical observations.

A12: High Energy Physics / 501

Deuteron production from phase-space coalescence in the GSI/FAIR energy regime

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UrQMD phase-space coalescence calculations for the production of deuterons are compared with available data for various reactions in the GSI/FAIR energy regime. It is found that the production process of deuterons, as reflected in their rapidity and transverse momentum distributions in p+p, p+A and A+A collisions at beam energy starting from 1A GeV, are in good agreement with experimental data. In addition we explore the energy dependence of the d/p ratio up to beam energies of $E_{lab} = 160A$ GeV and \bar{d}/\bar{p} up to $\sqrt{s_{NN}} = 7000$ GeV. A good description of the data, comparable to thermal model estimates, is observed. Most importantly this good description is based only on a single set of coalescence parameters.

A12: High Energy Physics / 526

Neutrino-antineutrino oscillation

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It had been a long time ago the neutrino-antineutrino considered to happen. In order for this process to take place, the neutrino must be massive Majorana particle. A massiveness neutrino has been revealed and established by the oscillation experiments. If the most promising experiment, neutrinoless double beta decay, can give a positive signal in the near future experiments then the sufficient and necessary condition for the neutrino-antineutrino oscillation to take place will be met. Up to now, the most well-known scheme for this process is regarded as a helicity-flipping process. A neutrino with certain helicity state at production point will propagate and this helicity state will oscillate such that at detection point it is detected with different helicity states from the initial state. This is the widely accepted scheme. From our point of view, this is not so. The non-vanishing neutrino mass opens up a new channel which is suppressed by the neutrino mass. Using this fact, we want to show that the famous suppression factor can come from either at production point or detection point. There is no such helicity-flipping process during propagation. Positive helicity will remain so from production and detection point and so does the negative helicity state.

A12: High Energy Physics / 517

Dual formulation of covariant duality-symmetric action of D3-brane

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We present covariant nonlinear duality-symmetric action of kappa-symmetric D3-brane in dual formulation. This construction generalises the Zwanziger action by using the PST-covariantisation, nonlinearisation, and suitable inclusions of coupling with external fields. The covariantisation made use of three auxiliary scalar fields. The theory possesses, in addition to other gauge symmetries, two local PST symmetries, which are essential to realise duality symmetry and to ensure that the three auxiliary scalar fields have no dynamics. The theory is also checked to possess kappa-symmetry. The equations of motion and on-shell action are also shown to match with those of the standard D3-brane action.

A12: High Energy Physics / 504

Implication of heavy-quark symmetry in chiral Lagrangian of nucleon, D meson and charmed baryon

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Inspired by the forthcoming experimental data at J-PARC and \overline{P} ANDA, 3-point vertices chiral Lagrangian for nucleon, delta, D meson and charmed baryon is constructed in the framework of the SU(2) flavor symmetry. There are 15 terms in the Lagrangian at the chiral power counting orders Q^0 . By applying the heavy-quark symmetry, that is, introducing degeneracy states of pseudoscalar and vector D mesons as well as spin 1/2 and 3/2 charmed baryons in the charm quark mass $M_c \rightarrow \infty$ limit, we have reduced the coupling constants of the chiral Lagrangian down to 7 free parameters at the leading order of $1/M_c$ expansion. The implication of the heavy-quark symmetry in physical processes are discussed. The chiral Lagrangian may be employed to study the charmed hadron production in J-PARC and \overline{P} ANDA.

A12: High Energy Physics / 489

Study of a non-constant EMC Cut Parameter for Electron and Positron Tracks with Clusters in the Calorimeter of the PANDA Experiment

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Suranaree University of Technology is a member of the antiProton ANnihilation at DARMstadt (PANDA) collaboration. The goals of this collaboration are to understand the weak and strong nuclear force, exotic states of matter and the structure of hadrons by building a detector at the Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany. At SUT, we are responsible for electromagnetic calorimeter (EMC) software development, in particular the tracking of charged particles. In this work, we study p_T dependent cut parameters to correlate tracks of electrons and positrons reconstructed from hits in the tracking system with clusters in the EMC. We find a bump in the EMC quality in the transverse momentum range of 0.8 - 2.0 GeV/c. Finally, we compare purity and completeness in a background event generator for the constant and non-constant cut and find that our new method yields a significant improvement.

A12: High Energy Physics / 495

Fitting coupling constant of ground-state charm baryons Λ_c, Σ_c by using decay width of quark model

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Decay process of ground state $\Lambda_c \rightarrow ND, ND^*, \Sigma_c \rightarrow \Delta D, \Delta D^*$ are studied in the 3P_0 nonrelativistic quark model with all parameters fixed in the sector of light quark. In accordance with the assumption that all baryons in question are made of three quarks, the effective coupling strength of

the 3P_0 vertex is determined by the decay processes of the $\Sigma(1385)$ baryon. The quark model results are applied to determine the coupling constants in effective field theory.

A12: High Energy Physics / 494

A study of charmed baryon production from chiral effective Lagrangian with heavy-quark symmetry and large- N_c constraints

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In this work, we will calculate the cross-section of charmed baryon production near threshold from $p\bar{p}$ annihilation processes. We employ 3-point vertices chiral effective Lagrangian of D-mesons, charmed and light baryons based on $SU(2)$ flavor symmetry, there are 15 terms in total. By using heavy-quark symmetry (HQS) and large- N_c operator analysis, one can reduce the number of low energy constants (LECs) down to 5. The reactions, $p\bar{p} \rightarrow \Lambda_c \bar{\Lambda}_c$, $\Sigma_c \bar{\Sigma}_c$ and $\Sigma_c^* \bar{\Sigma}_c^*$, are investigated by using our chiral effective Lagrangian with HQS and large- N_c constraints. Results from our work will be used to compare with several models in literatures. In addition, we hope that our results might be useful for planning the measurements of the relevant processes from the \bar{P} ANDA facilities in the forthcoming future.

A12: High Energy Physics / 492

Characterization of Monolithic Active Pixel Sensors with a 1 GeV Electron Beam at SLRI Beam Test Facility

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Abstract

A Large Ion Collider Experiment (ALICE) plans to upgrade the Inner Tracking Systems (ITS) during the second long shut down of the Large Hadron Collider (LHC) in 2019. The current ITS detectors will be replaced by new detectors based on Monolithic Active Pixel Sensors (MAPS) to enhance the tracking performance and momentum resolution. Several MAPS prototypes that integrate an image sensor and read-out circuit on the same chip such as Explorer, pALPIDE have been designed and developed by the ALICE collaboration. Suranaree University of Technology (SUT) and Synchrotron Light Research Institute (SLRI), as members of the ALICE collaboration, have been working together with the ALICE team on research and development of these sensors. The MAPS prototypes have been characterized and studied. In this work, the results of the characterization of the MAPS prototype,

pALPIDE with a 1 GeV electron beam at the SLRI Beam Test Facility (SLRI-BTF) will be presented. The detection efficiency of 99.6 has been obtained.

Keywords: Synchrotron Light Research Institute Beam Test Facility, ALPIDE (ALICE PixelDEtector), Monolithic Active Pixel Sensors

A12: High Energy Physics / 491

STUDY OF DOSE RATE IN THE BRAIN MODEL BASED ON THE NEUTRON BEAM OF SUT-MNSR

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Boron neutron capture therapy (BNCT) is tumor-cell targeted radiotherapy that has significant superiority over conventional radiotherapies. First in the world, Japan treated with BNCT for a patient with head and neck cancer in last century. So far, some clinical trials used by BNCT have been finished by reactor source. Now, SUT-MNSR (Miniature Neutron Source Reactor) is being designed and built, it will be a new reactor facility for BNCT research. According to SUT-MNSR physics design, SUT-MNSR will have the thermal neutron beam and epithermal neutron beam, the parameters of thermal and epithermal neutron beams are good enough for BNCT. Before SUT-MNSR is used for BNCT clinical trials (Brain tumor), the dose rate distribution in the body should be estimated. The paper will introduce the simulation for SUT-MNSR by Monte Carlo N-Particle Transport Code (MCNP) and the establishment of human brain model according to the brain tumor component and physics dose rate distribution in brain tumor by MCNP program.

A12: High Energy Physics / 490

Estimation of the mass of low-lying baryons and ground state pentaquarks

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Baryon mass spectrum has been studied over decades, but theoretical results are still largely inconsistent with experimental data. No need to mention the higher excited states, even the low-lying resonances, for example, theoretical works in the three-quark picture always predict a larger mass for the Roper resonance $N(1440)$ than for $N(1520)$ and $N(1535)$. In our work Baryon masses are estimated in the constituent quark model with Cornell potential, assuming that baryons consist of the q^3 as well as $q^4\bar{q}$ pentaquark component. Numerical calculations of the multi-quark mass spectrum are done with the hamiltonian in equation below. The roper resonance $N(1440)$ and $N(1535)$ and other low-lying q^3 baryons are interpreted, and the theoretical results of charmonium pentaquark states are in line with the candidates $P_c^+(4380)$, $P_c^+(4450)$ proposed by LHCb. Masses of pentaquark states $uud\bar{b}\bar{b}$ are predicted as well.

$$\begin{aligned} & \begin{array}{l} \begin{array}{l} H_N = \sum_{k=1}^N m^0_k + V_0 + \sum_{i=1}^{N-1} \frac{1}{2} (\vec{r}_i - \vec{r}_{i+1})^2 + \sum_{i < j}^N \left(-\frac{3}{8} \right) \lambda^C_{ij} \cdot \lambda^C_{ij} \\ r_{ij} = \frac{1}{2} (\vec{r}_i + \vec{r}_j) \end{array} \\ \end{array} \\ & \end{array}$$

A12: High Energy Physics / 488

Study of tetraquark spectroscopy in group theory and quark model

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In the past several years, a charged charmoniumlike Z_c^+ family, $Z_c^+(4430)$, $Z^+(4051)$, $Z^+(4248)$, $Z_c^+(4200)$, $Z_c^+(4240)$, $Z_c^+(3900)$, $Z_c^+(3885)$, $Z_c^+(3930)$, $Z_c^+(4025)$ and $Z_c^+(4020)$, has been successively observed by experimental collaborations. Obviously, those charged charmoniumlike states go beyond conventional $c\bar{c}$ -meson picture and prefer to tetraquark systems $c\bar{c}u\bar{d}$ due to carrying one charge, which provides a good place for testing various phenomenological research methods of hadron physics.

Permutation groups are applied to analyze the symmetries of multi-quark systems and, as examples, wave functions of meson and tetraquark states are constructed systematically in the language of Yamanouchi basis. Spatial wave function of tetraquark are evaluated in the Cornell potential. The explicit form of the spatial wave functions are derived from non-relativistic Schrodinger equation.

A13: Material Physics / 811

Influence of Ag Doping on Some Physical Properties of Y156 Superconductors Prepared by Solid State Reaction

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Since the discovery the first YBaCuO superconductor has been found in 1987, called as Y123 ($YBa_2Cu_3O_{7-x}$) superconductor. The effect of Ag_2O on the critical temperature was investigate. However, the new YBaCuO called Y156 superconductor was found, then we interest in effect of Ag_2O on some physical properties of this superconductor. The Y156 superconductor doped Ag_2O ($YBa_5Cu_6O_{13-y+xAg_2O}$ where $x = 0, 0.05, 0.10, 0.15, 0.20$) were synthesized by solid state reaction, with calcination temperature, and sintering temperature at $900^\circ C$, annealing temperature at $550^\circ C$. All of samples obtained were investigated by SEM, EDX, resistivity measurement, and the standard iodometric titration. The highest critical temperature was found in pure Y156 at 95 K. The lowest critical temperature was found in Y156 doped $0.05Ag_2O$ at 89K. We found that the surface of Y156 was improved by Ag_2O adding on the porous structure. The pore size in Y156 doped Ag_2O was smallest at $4.6 \mu m$ for Y156 doped $0.20Ag_2O$. The effect of the ratio of Cu^{3+}/Cu^{2+} depend on the critical temperature of Y156 doped Ag_2O was found.

A13: Material Physics / 770**Effect of calcination temperature on the conductivity of Sm and Cu co-doped ceria****Author:** Anuchit Sawangprom¹**Co-authors:** Apishok Tangtrakarn² ; korawit duengsa³¹ *Khonkean university*² *Khon kean university*³ *khon kean university***Corresponding Author:** anuchit_sawangprom@hotmail.com

The impact of different calcination temperature (550°C, 650°C, 750°C and 850°C) on the structural/electrical properties of sintered Cu/Sm co-doped CeO₂ prepared by sol-gel combustion were studied. The structural property was studied by X-ray diffraction (XRD) and Raman spectroscopy and ultraviolet visible(Uv-vis). The composition and chemical state of Sm/Cu and Ce and electrical conductivity of sintered sample were investigated by X-rays photoelectron spectroscopy (XPS) and electrical impedance spectroscopy (EIS), respectively. XRD pattern showed that all samples have a cubic fluorite structure. Moreover, XRD revealed that the crystallite size and crystallinity increased with the increasing calcination temperature. However, the lattice parameter and oxygen vacancy slightly decreased with the increasing temperature, which indicates the change of oxidation state between Ce⁴⁺ and Ce³⁺. The high conductivity were obtained for samples calcined at 750°C.

A13: Material Physics / 679**Preparation and Electrical Properties of Calcium Carbonate Nanoparticle****Authors:** Rachaya Sittipeng^{None} ; Fah Sala-ngam^{None} ; PANYA Khaenamkaew¹ ; Salisa Wangtong² ; Phansak Iamraksa²¹ *Kasetsart University*² *Department of Nautical Science and Maritime Logistics, Faculty of International Maritimes Studies, Kasetsart University, Chonburi, 20230, Thailand***Corresponding Author:** porloveple@thaimail.co.th

Calcium carbonate powders were prepared by precipitation method under the different annealing temperature etc. 300 °C, 350 °C, 400 °C and 450 °C. Surface morphologies and crystal structures of synthesized CaCO₃ powders were analyzed by SEM and XRD, respectively. The result show that the particle size is to be reduced with increase annealing temperature. The approximately particle size of annealed CaCO₃ powder was about 50-70 nm. X-ray diffraction analysis showed that the CaCO₃ powders were polymorph with the calcite and vaterite phase. Dielectric property of desired CaCO₃ was investigated. It was found that the dielectric constant decrease when the frequency of applied signal increases. In this study shows that, the precipitated nano-particle CaCO₃ properties are suitable for a humidity detector or fillers.

A13: Material Physics / 513**HSE hybrid functional calculation of absolute deformation potential in MgGeN₂**

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The ternary wide band gap semiconductor, MgGeN_2 is one of the group II-IV- N_2 compounds which have recently become potential alternatives for the group III-N materials. This is as the II-IV- N_2 has two different cations, so its electronic properties can be modified/tuned by varying the concentration of the group II or IV elements. The crystal structure of II-IV- N_2 can be considered as the super lattice of wurtzite structure, so the heterojunction between II-IV- N_2 and other wurtzite semiconductors (for example GaN and ZnO) is possible to synthesize. Therefore, it is customary to preliminarily acquire the potential-change associated lattice deformation (arisen from the lattice mismatch), via the investigation of absolute deformation potential (ADP). The ADP is the energy level shifting due to the distorted lattice. This potential is very important to extract the electronic properties in heterojunction semiconductors. In this work, we calculated the ADP of the valence band maximum (VBM), conduction band maximum (CBM), and energy gap of MgGeN_2 . The MgGeN_2 was considered as a prototypical investigating material due to its less lattice mismatch comparing to GaN and ZnO. In extracting the ADP, the derivative of the energy with respect the logarithmic volume was carried out, where in this work the volume deformation was allowed to range between -2% to 2% of the experimental bulk MgGeN_2 . Then, VBM, CBM and band gap were obtained using the Heyd-Scuseria-Ernzerhof hybrid functional (HSE) approach. The average electrostatic potential in each semiconductor was considered as a reference energy level instead of the core level, which is suitable for Norm-Conserving Pseudopotential approach used in this work. Then, the ADP and related results of the MgGeN_2 were also compared with the well-known GaN and ZnO. We found that the trend of energy shift due to strain in MgGeN_2 is larger than that of GaN and ZnO. These results of ADP therefore reveal energy shift characteristic associated to volume deformation, which could be useful for designing semiconductor applications based on the group II-IV- N_2 compounds.

A13: Material Physics / 453

Microstructural, Dielectric and Optical Properties of $[\text{KNbO}_3]_{0.9} - [\text{BaNi}_{0.5}\text{Nb}_{0.5}\text{O}_3]_{0.1}$ Perovskite Ceramics

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In this work, $[\text{KNbO}_3]_{0.9} - [\text{BaNi}_{0.5}\text{Nb}_{0.5}\text{O}_3]_{0.1}$ (KBNNO) perovskite ceramics are synthesized under various conditions by using the solid-state combustion technique. Their microstructural, Raman, dielectric, optical, and photovoltaic properties are investigated. X-ray diffraction spectroscopy reveals that the synthesized ceramics have a cubic structure. A high purity KBNNO sample is obtained at the sintering temperature of 1100C with the dwell time of 3 h. Raman spectroscopy of these ceramics shows a broadening of vibrational peaks for the sample sintered at 1130C, which implies an existence of impurity phases. The dielectric constant of 3000 at room temperature is obtained. The optical absorption of light in visible range as well as the photovoltaic response are observed in this ceramic. This work demonstrates the potential usages of KBNNO in electrical and opto-electronic applications.

A13: Material Physics / 432

Optical properties of Mn-doped CdS Thin films Grown by the SILAR Method

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In this research, the manganese doped cadmium sulfide (Mn-doped CdS) thin films were prepared on glass substrates using successive ionic layer adsorption and reaction (SILAR) method. The thin films were prepared by different mixing percentage of manganese with cadmium sulfide precursors in the range of 1 - 20 mole%. The optical properties were investigated by ultraviolet-visible spectrophotometer. The morphology and elemental analysis were investigated by scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS), respectively.

A13: Material Physics / 802

Synthesis of titanium and diamond-like carbon thin films bi-layers used as an electrode for electrochemical advanced oxidation in diuron degradation by dc magnetron sputtering

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Diuron is famous pesticide and its residual can contaminate in natural water resource resulting in environmental issue and human health. There are several processes that have been used to overcome diuron contamination including adsorption, biochemical, and advanced oxidation processes. An electrochemical advanced oxidation process (EAOP) is one of the advanced oxidation processes used to degrade Diuron with high efficiency. In this research, the binary layers of titanium and diamond-like carbon (Ti/DLC) thin films were deposited by dc magnetron sputtering method on the surface of 304 stainless steel substrates to be utilized as electrodes for EAOP. The effect of nanostructure of diamond-like carbon thin films on diuron degradation and corrosion of electrode were studied. The Ti/DLC bi-layers were characterized by XPS. The results show that the samples of Ti/DLC bi-layers, synthesized under the operating pressure of 5, 20, and 25 mTorr, demonstrated the sp^2/sp^3 ratio of 0.345, 0.327, and 0.544 respectively. The Ti/DLC bi-layers were used as electrodes of EAOP in the microchannel reactor for diuron degradation. The diuron concentration during the process was investigated by HPLC. It could be observed that the Ti/DLC bi-layers with the high sp^2/sp^3 ratio (0.544) exhibited the highest removal efficiency, up to 69 percent within 200 seconds of the residence time in a microchannel reactor. The Ti interlayer could improve the adhesion between DLC thin films and the substrate, hence, reducing the corrosion of electrode.

A13: Material Physics / 774

Structural and electronic properties of MXene phase of Mo₂C under external stresses

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Mxene is a group of 2D materials known for their promising properties for industrial electronic devices and gas sensing behavior. The objective of this study is to investigate the electronic property of a MXene named dimolybdenum carbide (Mo_2C) under applying biaxial stress and our problem is how will the material change when biaxial stress is applied. All the possible phases have been atomistically optimized by using GGA-PBE functional with energy cut-off 650 eV, in order to verify the thermodynamic stability. It is found that the most stable phase is $P3\bar{m}1$ (Mo_2C) with lattice parameters of $a = 3.054 \text{ \AA}$ and $c = 4.656 \text{ \AA}$. The $P3\bar{m}1$ phase has been cleaved to be the MXene structure and investigated for the relative properties. The biaxial stress has been reversely calculated with optimized atomic configuration of fixed biaxial stain varied up to 45%. The finding shows that Mo_2C is a non-magnetic material which is in good agreement with previous calculation. By applying biaxial strain, the stress-strain relation indicates that elastic limit is at strain of 15%. The MXene structure is formed by ionic bonding between 2p-C and 4d-Mo states. We can conclude that there are certain changes from normal in this material when applying biaxial stress. For further work, the electronic property will be carefully interpreted, as well as the superconductive behavior of this MXene when under biaxial stress will be carried out.

A13: Material Physics / 619

Sintered Fe-Mo-Si-C alloys with ductile cast iron microstructure

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Sintered Fe-Mo-Si-C alloys, produced by admixing 4.0 wt.% silicon carbide to two different pre-alloyed powders with compositions of Fe-0.85Mo and Fe-1.5Mo, sintering at 1250°C for 45 minutes and cooling in a vacuum furnace, showed a microstructure similar to that of a ductile cast iron. The microstructure of the sintered alloys was characterized by the bull's eye structure consisting of a black particle surrounded by ferrite shell and harder shell of pearlite/bainite, respectively. With the influence of alloying element content in the pre-alloyed powders, the proportion of the harder shell, particularly the bainite fraction, increased with increasing molybdenum content. Due to the matrix hardenability via bainite formation by the molybdenum influence, tensile strength of the sintered alloys increased but elongation decreased with increasing molybdenum content.

A13: Material Physics / 604

Effect of Destabilisation and Tempering on Microstructure and Hardness of 28 wt.%Cr-(1-4) wt.%W Cast Irons

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High chromium cast irons are widely used for wear-parts in the mining, mineral and cement industries, due to their high abrasion resistance, relative low cost and ease of production. Carbide-forming elements addition and heat treatments were improved their properties. In this work, the effects of W addition and heat treatment on the microstructure and hardness of nominal 28 wt.%Cr high chromium irons were studied. As-cast samples were destabilised at 1050 °C for 4 hours and then hardened by air cooling. Tempering after destabilisation was done at 450 °C for 4 hour and then air cooling. X-ray diffractometry, light microscopy and scanning electron microscopy were used to characterize the microstructures of the irons. Vickers macro-hardness was tested. The results show that the as-cast microstructure of the iron without W addition consisted of primary austenite dendrites with eutectic M_7C_3 and eutectic austenite partially transformed to martensite. The iron with (1-4) wt.%W addition were hypereutectic contained primary M_7C_3 and eutectic M_7C_3 in an austenite matrix. In the iron with 4 wt.%W, M_6C carbide was found. Destabilisation treatment of the austenite matrix allowed precipitation of secondary carbides and transformation to martensite during air cooling. After tempering, more secondary and tempered carbides precipitated within the matrix and eutectic austenite. After heat treatment, phase transformation of eutectic M_7C_3 was also found in the iron with (1-4) wt.%W addition. The formation of primary M_7C_3 and M_6C carbides in the iron with W addition increased the as-cast macro-hardness from 500 HV₃₀ (no W) to 550 HV₃₀ (4 wt.%W). Destabilisation increased the macro-hardness up to 740 HV₃₀ (no W) and 870 HV₃₀ (4 wt.%W), respectively. This is believed that secondary carbide precipitation allowed austenite to transform to essentially martensitic matrices. Tempering after destabilisation slightly increased the macro-hardness.

Keywords: High chromium iron, Heat treatment, Microstructure, Tungsten, Hardness

A13: Material Physics / 530

Optimization of multi-layer graphene/PMMA synthesized by low pressure chemical vapor deposition from acetylene precursor

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High quality and large scale graphene are required for large-scale applications, especially transparent conductive flexible touch-screen panels. Chemical vapor deposition is so far the best method for the synthesis of high quality graphene in the large scale. In this work, we have synthesized multi-layer graphene on copper foils by low pressure chemical vapor deposition from acetylene precursor at the flow rate of 20-40 mL/min and with reaction times from 10-30 minutes. Graphene on copper foils were then coated with PMMA and transferred by wet chemical etching method. The transmittance and electrical properties of graphene on polymer were investigated. The Raman spectrum of graphene synthesized with the acetylene flow rate of 30 mL/min for 10 minute showed the characteristics of bi-layer graphene (I_{2D}/I_G is 1.6) with the lowest resistance values and best transmittance compared with other conditions.

A14: Environment / 745

Structure and Mechanism of Phayao Fault Zone: Understanding the origin of 5th May 2014, M_w 6.5, Pan earthquake and its after-shocks

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The 5th May 2014 Chiang Rai earthquake is the largest earthquake in Thailand. The mainshock followed by thousands of aftershocks which located in both Pan segment (PS) and Mae Lao segment (MLS) of Phayao Fault Zone (PFZ). This complication of aftershock pattern leading to the intriguing question about the origin of mainshock whether it's come from MLS or PS. The seismological and electromagnetism methods were integrated to study the PFZ fault zone structure and its earthquakes behavior. We applied the moment tensor inversion to the seismic waveform generated by earthquakes with local magnitude (M_L) greater than 4. The earthquake moment tensor solutions indicate that fault is moving in a horizontal plane as strike-slip faulting. However, because of the non-uniqueness of the solution, using only earthquake moment tensors cannot answer whether those earthquakes were derived from MLS or PS. From regional earthquake analysis, the regional stress field orientation is dominated in NNE-SSW with uniaxial horizontal compression. The combination of fault plan and stress field orientation indicate that MLS segment has higher shear stress than PS. We applied 3-D magnetotelluric (MT) survey (31 sited) around the PFZ to reveal the deep crustal resistivity structure beneath the fault. The most important feature of the subsurface image is the conductive anomalies beneath the MLS. Granitic rock and hot springs in an area suggest that conductive body is fluid-rich rock. This fluid-rich body reduces the normal stress and effective friction along the MLS fault plane. The interpretation of structure and mechanism can be concluded that fault plane of MLS has a high instability in the regional stress field. Also, the fluid underneath MLS also weakens the fault segment by reducing its effective stress friction. The source time function of mainshock presents a multi-stage rupture behavior. Thus, the initial motion of mainshock may start in Pan segment but the main energy of M_w 6.5 was radiated by Mae Lao segment.

A14: Environment / 486

TNRO: current status and its benefits for geophysics

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Since October 2016, NARIT has been preparing for a mega-project: Thailand national radio observatory (TNRO). It is a collaboration with the national geographical institute of Spain (IGN) to construct and operate a 40-metre radio telescope in Chiang Mai, Thailand. This presentation reviews the current status of the project. A plan of the construction is stated as well as expected outputs and academic researches. We would like to point out that the telescope will serve not only for astronomical purposes but also geodetic very-long-baseline interferometry (VLBI). The Geodetic VLBI could provide precise positions up to the level of 1 millimetre. Therefore, there are potential benefits for geophysical studies in an area of Northern Thailand especially about movements of tectonic plates.

A14: Environment / 620

Atmospheric Modelling Systems for Southeast Asian Region

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Atmospheric Modelling Systems have been set up on 3 High Performance Computing (HPC) environments in the Southeast Asian Region. Weather Research and Forecasting with Chemistry (WRF-Chem) model, various versions from 3.5.1 to 3.9.1, has been implemented over regional domains; 1) stretching across 5000 x 4500 km centred at Kathmandu, 2) covering parts of Karakorum mountains and Hindu-Kush Himalayas in Northern Pakistan, 3) extending from Myanmar to Thailand and Indochina. The chemical transport model has been used for making assessments with the attempt to understand atmospheric processes and eventually forecast the air pollution episodes, not only during the winter seasons in Nepal and northern India, such as persistent fog or smog, but also the interaction between atmospheric chemistry and South Asian Monsoon, focussing on the monsoon onset dates and precipitation trends on the mountains, during recent past. Meteorological data from routine observation from each country are compared with meteorological output of the WRF simulation for each time periods, so to find the best fit microphysics, short and long-wave radiation parameterization and boundary layer schemes. Preliminary finding is that WRF-Chem is suitable for the region, provided that the emission inventory is improved to capture the actual activities. Only then the modelling systems become useful for supplying the necessary information to policy makers in the region by generating scenarios on possible mitigation actions within each country or across the region, in order to make a joint implementation plan on the transboundary issues of air pollution.

A14: Environment / 514

Estimation of daily global solar radiation at Lopburi province from meteorological parameters using artificial neural network

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Solar radiation is important to all living organisms and it is the energy source for solar technologies such as photovoltaic and solar thermal systems. Generally, the amount of incident solar radiation can be obtained from ground-based measurements. However, the number of solar radiation monitoring stations is very limited. In this work, the artificial neural network (ANN) was proposed to derive the amount of incident solar radiation at Lopburi province (14.83°N, 100.62°E). This ANN has one input layer, two hidden layers and one output layer. The input layer consists of air temperature, air relative humidity, visibility, cloud cover, wind speed and air pressure, and the output layer is daily global solar radiation. The ANN was trained using the input and output data collected at Lopburi meteorological station during the year: 2007-2014. Then it was validated against the data at the same station for the period of three years (2015-2017). The validation results show that solar radiation obtained from ANN and that from the measurement are in reasonable agreement, with root mean square error of 12.8% and mean bias error of -1.6%.

A14: Environment / 512

Estimation of Atmospheric Precipitable Water Vapour in Thailand using an Artificial Neural Network

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Water vapour is a main natural greenhouse gas and has impact on the atmospheric system. Atmospheric water vapour can be quantified as precipitable water vapour (PWV). In general, PWV can be derived from radiosonde and spectral solar radiation measurement data. However, the spatial distribution and temporal frequency of the measurements are usually limited due to high equipment and operational costs. In this work, an Artificial Neural Network (ANN) was proposed to estimate monthly average PWV using surface ambient air relative humidity (rh), surface ambient air temperature (Ta), saturated water vapour pressure (pvs) and month (m) as input data. The multi-layer perceptron ANN was employed for deriving PWV. The input layer of this ANN comprises rh, Ta, pvs and m, and the output layer consists of only one parameter, namely PWV. Additionally, this ANN has two hidden layers. A five-year period (2009-2013) of the input and output data collected from three meteorological stations, namely Chiang Mai (18.98°N, 98.98°E), Ubon Ratchathani (15.25°N, 104.87°E) and Songkhla (7.20°N, 100.60°E) were used to train the ANN employing the back propagation algorithm. A two-year period (2014-2015) of the input and output data from these stations were used to evaluate the performance of the trained ANN. It is found that PWV derived from the ANN agrees well with that obtained from the measurement, with the discrepancy in terms of root mean square error (RMSE) and mean bias error (MBE) of 7.6% and -3.5%, respectively.

A14: Environment / 505

A model for calculating daily near infrared solar radiation

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Near infrared solar radiation (NIR) represents a large amount of the total energy of the solar spectrum. NIR is important for applying to remote satellite approaches in order to investigate an atmospheric water vapour and for other solar energy thermal applications. However, it was less investigated compared to another solar spectrum bands. Additionally, measurements of NIR are also scarce. Consequently, NIR data are not sufficient for those applications. In this work, a semi-empirical model for calculating daily global NIR was developed. The model is written in the form of the ratio of daily global NIR (H_{NIR}) to daily global broadband solar radiation (H) as an empirical function of atmospheric parameters influencing H_{NIR}/H namely, precipitable water (PW), total ozone column (TOC), aerosol optical depth (AOD) and cloud index (n). A 5-year period data of H_{NIR} , H , PW, TOC, AOD and n obtained from 4 meteorological stations situated in the main regions of Thailand were used to calculate the empirical coefficients of the model. This model was tested against an independent measured data set. It is found that H_{NIR} calculated from the model and that from the measurement are in good agreement, with the difference in terms of root mean square error of 7.7% and mean bias error of 5.3%.

A14: Environment / 809

Study fish crackers from NARATHIWAT province drying for low oil by microwave oven

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In this research, we investigated the drying of fish cracker from Narathiwat province by microwave oven. It will study the electric power transfer to microwave power. For fish cracker drying, we measure mass and moisture content various with time, density of fish cracker before and after drying, humidity absorption. By study at electric power 300W and 500W. The result at electric power 300 W, it transfer to microwave power 44.58 W and a electric power of 500 W, the microwave power is 206.21 W. The mass change with time after drying at electric power 300 watts various by equation $m=1.62 \times 10^{-3}t^2-3.70 \times 10^{-2}t+2.68$. And electric power 500 watt mass change by equation $m=2 \times 10^{-6}t^2-1 \times 10^{-3}t+2.74$. For fish cracker put centre of disk moisture content decrease faster than rim of disk. Fish cracker put at centre has humidity absorption more than rim of disk and electric power 500 W can absorb humidity faster than electric power input 300 W.

A14: Environment / 593

The Influence of Meteorology on ambient PM2.5 and PM10 concentration in Chiang Mai

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Abstract

A concentration of particulate matter (PM), i.e. PM10 and PM2.5, peaks annually in March from 2015 to 2018, exceeding both Thailand emission (24-hour averaged 120 $\mu\text{g}/\text{m}^3$ for PM10 and 50 $\mu\text{g}/\text{m}^3$ for PM2.5) and World Health Organization (WHO) standards. This study will consider relationship between the PM concentrations and meteorological data of Chiang Mai in 2018 affecting the highest PM near surface. The hourly PM10 and PM2.5 concentrations in Chiang Mai town reach the maximum values on 30 March 2018 by two stations 35T and 36T. The former is 155.22 $\mu\text{g}/\text{m}^3$ at 35T and the latter is 117.73 $\mu\text{g}/\text{m}^3$ at 36T, superior to the Thailand standard. When both PM concentrations are over the standard, slightly stable atmosphere are occurred as indicated by E-class stability plot. Furthermore, an atmospheric inversion near surface appears from ground level to approximately 660 mb as shown in Skew-T diagram so air pollutants in Chiang Mai are trapped underneath 50 meters height of planetary boundary layer. Persistent slightly stable and neutral atmosphere (E and D class respectively) approximately 24 hours in Chiang Mai also encourages surplus PM10 and PM2.5 from 28 to 30 March 2018 in accordance with low speed western and south western winds (1 m/s to less than 4 m/s).

Keywords: ambient PM2.5 and PM10, meteorological data, atmospheric turbulence, surface temperature inversion

A14: Environment / 673

Theoretical study in efficiency of modified Zeer refrigerator

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Zeer refrigerator is an evaporative cooling system which use evaporation of water to lower temperature inside the refrigerator. Its rate of evaporation which affects rate of heat loss depends on surface area of the refrigerator. Conventional Zeer refrigerator can't be built in large scale because its efficiency and terminal temperature difference between inside refrigerator and ambient environment drops as the rate of heat loss per volume decreases to the point where its efficiency isn't suitable for vegetable preservation. We interest in developing Zeer refrigerator with greater efficiency by increasing the surface area to volume ratio of the refrigerator. We develop theoretical model which is used to study the effect of the dimension of Zeer refrigerator, ambient temperature and relative humidity on the temperature difference of the refrigerator. The results from theoretical model are matched with results from experiments performed on prototype of Zeer refrigerator. The results from theoretical model show that Zeer refrigerator will operate with high efficiency at high ambient temperature and low relative humidity. Modified Zeer refrigerator has greater efficiency compare to conventional Zeer refrigerator. The difference in efficiency becomes significant when the refrigerator is built in large scale. Therefore, modified Zeer refrigerator is possible to be built in large scale while having efficiency viable to preserve vegetable.

A14: Environment / 442

Method to determine the single curve IV characteristic parameter of solar cell

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Solar cell I-V characteristics curves are basically representation of relationship between the current and voltage at the existing conditions of irradiance and temperature. I-V curves provide the information required to configure a solar system. The parameters values of V_{oc} , I_{sc} , V_m , I_m and P_m , which can be experimentally measured. However, the circuit parameters reverse saturation current density (I_0), ideality factor (n), series resistance (R_s) and shunt resistance (R_{sh}) at a certain solar irradiance and ambient temperature can be obtained by solving the governing equations of the solar cell. The purpose of this paper is to determine the I_0 , n , R_s , and R_{sh} by the single IV-curve and the standard model of solar cell under different the irradiance intensity level (600-1000 W/m², temperature 25 °C) is being done in this paper. From the results of these experiments we found that, the value of I_0 is between 4.78×10^{-5} A to 7.19×10^{-5} A and n of between values is 1.33 to 1.39. The increasing of I_0 and n are caused by the increase in the recombination current at high irradiance intensity. On the other hand the parasitic resistance of R_s and R_{sh} are decrease at high intensity irradiance.

A14: Environment / 716

Effect of Position of fins to Heat Transfer of a Closed-Loop Oscillating Heat Pipe with Check Valves

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Effect of Position of fins to Heat Transfer of a Closed-Loop Oscillating Heat Pipe with Check Valves

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Abstract. This research aimed to determine the effect of position of fins to closed-loop oscillating heat pipe with check valves (CLOHP/CV) at top heat mode. To check on heat transfer rate needed to focus on evaporator temperature, air velocity, and position of fin. All heat exchangers used ethanol as working fluid with the filling ratio of 50% by total volume of tube, evaporator temperature at 60, 70, and 80 degrees Celsius, and air velocity at 0.5, 1.0, and 1.5 meter per second, size of fin was 0.5 centimeter. All heat exchangers used different positions at evaporator and condenser and 2 parts. The CLOHP/CV was made from copper capillary tube of (inner diameter: 5 mm), 24 turns 2 check valves. The length of evaporator and condenser and adiabatic is 20, 20, and 10 centimeter respectively. From the experiment it's was found that the heat exchanger of both finned tubes had a temperature of 80 degrees Celsius and a wind speed of 1.5 m / s with heat transfer rate and thermal effectiveness the highest.

Keyword: CLOHP/CV, Fins, Heat transfer, Thermal effectiveness, Heat Mode

A14: Environment / 650

Heat Transfer of a Heat Pipe on fins using Silver nanofluid

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Heat Transfer of a Heat Pipe on fins using Silver nanofluid

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Abstract

This research aimed to determine the heat transfer rate of the heat pipe using Silver as a working fluid. The CLOHP/cv in this study was made of copper. The copper tubes and fins have an outside diameter of 5.16 mm. The lengths of the evaporator, adiabatic and condenser sections are 200, 100 and 200 mm, respectively. The radii of fins is 0.5 cm. The CLOHP/cv had 24 tubes with Silver-nanofluid as the working fluid, and a filling ratio 50% of total volume. The evaporator section was heated by a heater, while the condenser section was cooled by fresh air. The hot air was controlled to 60 70 and 80 degrees Celsius, and the fresh air velocities were adjustable to three levels: 0.5, 1.0 and 1.5 m/s. The test operation was focused on the heat transfer rate and thermal effectiveness of the CLOHP/cv. It was found that the maximum value of the heat transfer rate and thermal effectiveness occurred when the air velocity and hot air temperature were 0.5 m/s and 80 degrees Celsius, respectively.

Keyword: Silver nanofluid; Fins; Working fluid; Heat transfer; Thermal Effectiveness

A14: Environment / 510

The effect of vortex generator materials and L/D ratios on performance of stainless vortex tube

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The present study was carried out an experimental investigation on the effect of vortex generator materials and length to diameter ratios (L/D) on the performance of a vortex tube. The vortex tube was made from stainless. The vortex generator materials are stainless and brass. The ratio of length to diameter of the vortex tube was studied at 17.5 and 20. This experiment tested at inlet air pressure 1.5 bar and the cold mass fraction vary from 0.4 to 1. The results showed that the cold air temperature difference, hot air temperature difference and isentropic efficiency of the stainless vortex tube with stainless vortex generator were higher than the stainless vortex tube with brass vortex generator at 22%, 5% and 13.5% respectively. In term of L/D ratio, the result shows that the cold air temperature difference of the vortex tube with the ratio of 17.5 was higher than the vortex tube with the ratio of 20 at 4%. Both are close in the value of a hot air temperature difference and isentropic efficiency. It is also found that the stainless vortex generator and the L/D ratio of 17.5 have the highest performance achievement.

A14: Environment / 468

Utilization of PbI₂ recycle for perovskite solar cell fabrication

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Perovskite solar cells have several advantages over traditional solar cells such as the ability to control the film morphology during the deposition and crystallization of the perovskite layer. The efficiency of perovskite solar cells can be modified using physical and chemical techniques to achieve better efficiencies. In this paper, we study the fabrication of typical inverted structure perovskite solar cell using PbI₂ recycle. The optimization condition of PbI₂ recycle based perovskite solar cell is reported with the maximum power conversion efficiency of 4.14% which is comparable to the cell made by fresh PbI₂. Our finding has shown the potential of reuse PbI₂ precursor which eventually leads to cost reduction in perovskite solar cell fabrication.

A15: Atomic / 750

Temporal Auto-Correlation Function Pushed to One Pixel Limit

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Quantum transport in a neutral atom guide provides intriguing quantum effects that are important aspects in designing atom mechatronic structures such as quantum interferometer, pump, valve, and amplifier structures. We investigate applicability of spatial reduction in temporal auto-correlation function to reduce computational resources in finding eigen-energy inside the guide. We find that we can reduce the size of the correlation function to an area 65,536 times smaller than the entire simulation space (0.0015%), which corresponds to an area of one pixel. The maximum error of all energies is 8.18% for a ground state and the trend of errors reduces exponentially as the principle quantum number increases. The setting of the investigation involves initial Gaussian wave packet evolving in a 2D harmonic potential and the correlation space is concentric to the center of the initial wave packet.

A15: Atomic / 797

Gibbs Energy Additivity Approaches in Estimation of Density of Fatty Acids

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Density is important physical property of a liquid. In this work, correlation of density of fatty acids (FA) is correlated to the Martin's rule of free energy additivity for estimated density from either (1) its number of carbon atoms (of fatty acid, z) and number of double bonds (nd) or (2) its saponification number (SN) and iodine value (IV). Data collected from literatures were used to validate, and support the proposed models. The proposed equations are easy to use and the estimated density values of FA at different temperatures form agree well with the literature values. The average absolute deviation of density of FA at 297.05-394.25 K is 0.17%.

A15: Atomic / 779

Spectral Pattern of a Complex Potential Guide

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Introduction of an absorption boundary to an atom guide enriches the guide's transport properties. However, if the initial wave packet contains broad energy spectrum that includes scattering states, a complex boundary essentially changes the composition of the system's energy-eigen spectrum. Our study focuses on finding a pattern of energy spectra that governs the evolution of the system. In this work, we investigate eigen-energy of a particle traversing a finite square well by varying the slope of the absorption boundary. We find that the steepness of the slope selectively filters out high energy eigen-states without shifting them, thus the low-pass filter. Furthermore, it forces eigen-states with high energy to have very narrow spectral linewidths.

A15: **Atomics** / 726

Calculation of Wave Function and Energy Levels of Muonic Atom

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The calculation of relativistic quantum wave function and energy levels of a muonic atom are performed in this work. We begin by solving the Dirac equation using the Notre Dame basis (ND) method with the Coulomb potential. The obtained results agree very well with other methods [1]. We improved the leading correction terms with a finite charge distribution from a nucleus atom and vacuum polarization for better estimates of the transition energies of a muonic atom. In this case, our results are different from other numerical methods, but they show similar trends, and the level spacing is comparable within 5% errors. We further improve our calculations with the dual-kinetic-basis (DKB) method with additional correction terms from recoil energy, and hyperfine structure.

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A15: **Atomics** / 577

Qubit tomography with limited resources of continuous weak measurement and qubit controls

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We investigate a new method for qubit state tomography [1] based on limited resources of continuous weak measurement [2] and qubit controls. As in many qubit experiments, such as in superconducting circuits, the qubit measurement could practically be done with only a few observables, e.g., continuously measuring σ_z observable of a superconducting qubit [3]. To determine a full density matrix of a qubit system, one needs to add unitary controls in order to transfer information about other parameters of the qubit's state to the measured observable. In this work, we use only a continuous σ_z measurement of a qubit with arbitrary (weak) strength and a fixed-axis Rabi oscillation control. We use the Bayesian mean estimation to construct the qubit states from measurement records. We also investigate the information transfer during the continuous measurement, and how the information of different qubit coordinates are transferred to the measured observable by considering the Fisher information. Our results show that we can get the state estimators with high fidelity using a small strength of measurement, along with qubit rotation about the Rabi axis making an $\pi/4$ with the x -axis, y -axis and z -axis. In addition, the variance of the estimators shows similar trend as those under fluctuation of many iterations.

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A15: Atomic / 520

An investigation of relationships between the usual Quantum Harmonic Oscillator and its one-parameter family version

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We study Hamiltonian of one-parameter family yielding the Newton equation. In particular, we are interested in its prescription for quantum harmonic oscillator. A modified perturbation theory is used to evaluate the spectra and the eigenfunctions of the Hamiltonian. Spectra we obtain seem to agree with those of the usual Hamiltonian. We also study this Hamiltonian with additional term αx^4 to get the Newton’s equivalent anharmonic oscillator Hamiltonian. Our spectrum depend on the one-parameter family.

A15: Atomic / 519

SPECTRAL ANALYSIS OF 1-PARAMETER FAMILY NEWTON’S EQUIVALENT HAMILTONIAN WITH SQUARE WELL POTENTIALS

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Alternative Hamiltonians yielding Newton’s equation which expressed in 1-parameter family are studied. These Hamiltonians called Newton’s equivalent Hamiltonians (NEH) give the same Newton’s equation. After quantization and a suitable ordering, a 1-parameter family Newton’s equivalent quantum Hamiltonians (NEQH) is introduced. The property of NEQH is that as limit of parameter $\beta \rightarrow 0$, the NEQH will recover to standard Hamiltonian. Eigenenergy and wavefunction of NEQH are analyzed by using Schrödinger equation for both infinite square well and finite square well potentials. For both systems, the wavefunction of NEQH is exhibited the same form to standard case. But, the discrete energy spectrum is different from standard one due to the parameter β . Moreover, at limit of $\beta \rightarrow 0$ the energy spectrum generated by NEQH will recover to energy spectrum of standard Hamiltonian.

A15: Atomic / 427

Correlation of Isentropic Compressibility of Biodiesel to Its Saponification Number and Iodine Value

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Isentropic compressibility is important injection timing of liquid fuel. The isentropic compressibility of biodiesels are correlated to number of carbon atoms, number of double bond(s) and temperature. In this work, an empirical approach for isentropic compressibility of biodiesels can be estimated by using saponification number (SN) and iodine value (IV). The proposed equations are easy to use and the estimated isentropic compressibility values of biodiesels at different temperatures agree well with the literature values. The average absolute deviation of isentropic compressibility values of biodiesels at 288.15-343.15 K is 1.19 %. The isentropic compressibility outside temperature between 288.15 and 343.15 K may be possibly estimated by this model but accuracy may be lower.

A15: Atomic / 493

A study of two qubits system with Quantum operator formalism

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An open system, which consists of the decay of the excited state of two two-level atoms due to the stimulated emission of photons, has been studied in the quantum operator formalism. The Kraus operators are constructed to describe the time evolution of the composite system in terms of the interaction Hamiltonian between atoms and the electric field (a vacuum cavity that can generate photons). Afterward, we will apply the Kraus operators to derive the density matrix for analyzing the stability of the entanglement of two qubits system.

A15: Atomic / 568

The Stark Effect of Barium atoms in Rydberg states

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We present the precise calculation of the Stark effect of Rydberg states of Barium atoms using the empirical values of the energy states of Barium in the perturbed Hamiltonian. We construct the Stark map by diagonalizing the total Hamiltonian to the first order to get the eigenenergies in the static field. We compare the calculated results with the experimental Stark map of Barium atoms transition from 6s32d to 6s29k for $k \geq 5$ conducted in the laboratory.

A15: Atomics / 521**Effect of depolarizing noise on entangled photons****Author:** Ruchipas Bavontaweepanya¹¹ *Rangsit University***Corresponding Author:** ruchipas.b@rsu.ac.th

Entangled photons are important resources for quantum information. Especially, in quantum cryptography, the polarization entangled photons are highly secure. However, the entanglement of photon can hold in isolated system. In realistic system, the entangled photons inevitably interact with environment. In this work, we study the effect of depolarizing noise on the two entangled qubits. The entangled photon are prepared with different entangled states and send to the depolarizing channel. We measure the entanglement by using concurrence. When the entangled photons interact to the depolarizing noise, the entanglement property of photons will be degraded. The concurrence of entangled photons reduce to 0.

A16: Magnetic and Semiconductor / 744**Magneto-optical determination of the topological character of $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ topological crystalline insulator****Authors:** Thanyanan Phuphachong¹ ; Badih A. Assaf² ; Valentine V. Volobuev³ ; Günther Bauer⁴ ; Gunther Springholz⁵ ; Louis-Anne de Vaultier² ; Yves Guldner²¹ *Department of Physics, Mahidol Wittayanusorn school, 364 Moo. 5, Salaya, Phuttamonthon, Nakhon Pathom 73170, Thailand*² *Laboratoire Pierre Aigrain, Département de Physique, Ecole Normale Supérieure, PSL Research University, CNRS, Université Pierre et Marie Curie, Sorbonne Universités, Université Denis Diderot, Sorbonne Cité, 24 rue Lhomond 75005 Paris, France*³ *Institut für Halbleiter und Festkörperphysik, Johannes Kepler Universität, Altenberger Straße 69, 4040 Linz, Austria*⁴ *Institut für Halbleiter und Festkörperphysik, Johannes Kepler Universität, Altenberger Straße 69, 4040 Linz, Austria*⁵ *Institut für Halbleiter und Festkörperphysik, Johannes Kepler Universität, Altenberger Straße 69, 4040 Linz, Austria***Corresponding Author:** t.phuphachong@gmail.com

This present work focuses on the study of the electronic properties under magnetic field and the topological character of lead-tin selenide ($\text{Pb}_{1-x}\text{Sn}_x\text{Se}$) topological crystalline insulator (TCI) [1]. This semiconductor material belongs to a novel class of topological materials which generally exhibit Dirac-like dispersion of insulating bulk states with band gap coexisting with gapless conducting surface states at the boundaries, as found in the well-known existing Z_2 topological insulators (TIs) [2]. This intriguing peculiar aspect protected by time-reversal symmetry results directly from the inversion, caused by the spin-orbit interactions, of the lowest conduction and the highest valence bulk bands having different parities. Therefore, the topological character of condensed materials is fundamentally governed by the bulk band parity and orbital ordering. A semiconductor is said to be “trivial” when its bulk bands are normal (with positive band gap), while it is said to be “nontrivial” or “topological” when its bulk bands are inverted (with negative band gap) compared to conventional semiconductor. To change the band ordering, the material must undergo a topological phase transition from trivial regime to topological regime.

The inversion of the bulk band ordering can also be observed in TCIs such as a narrow gap (< 1 eV) rocksalt IV-VI semiconductor $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$. For a given temperature, there exists a critical Sn composition x_c at which the topological phase transition occurs [3]. For $x < x_c$, $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ is trivial since it behaves as conventional semiconductor. For $x > x_c$, such a material has been shown to display similar insulating bulk states and topological surface states (TSS) as in the case of TIs, but

the TSS are protected by the crystalline symmetry of the system. In this work, high-quality (111)-oriented $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ ($0 \leq x \leq 0.3$) films epitaxially grown on BaF_2 substrates by means of molecular beam epitaxy (MBE) were performed at 4.5 K using magneto-optical absorption spectroscopy in the infrared spectral range (4-930 meV) with magnetic field up to 15 T. This principal investigation is an ideal technique used to probe narrow gap semiconductors as it provides quantitative information about the bulk band parameters via the Landau quantization of the electron states [4]. The minima of the transmission spectra correspond to optical transitions between Landau levels. This allows us to extract the band parameters of both the bulk and TSS, i.e. the Dirac velocity and the Dirac mass or the energy gap, of the material using the Dirac fermion model analysis [5,6,7]. Experimental findings from a systematic study demonstrate that a topological phase transition in our TCI $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ films takes place in the vicinity of $x_c \approx 0.16$ [7]. For $x < 0.16$, the band gap is positive and the material is in trivial phase, while for $x > 0.16$ the band gap becomes negative and the material is in topological phase. The latter is confirmed by the observation of the cyclotron resonance of the TSS. The heart of our analysis is the ability to verify whether a material is trivial or topological by comparing the value of a considered bulk Dirac velocity v_D with the critical Dirac velocity v_c measured at x_c . For a Dirac material such as $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ that can be described by a Bernevig-Hughes-Zhang (BHZ) Hamiltonian, v_D and v_c are related to a topological index η as follows: $(-1)^\eta = \text{sign}(v_D^2 - v_c^2)$ [7]. We found experimentally that when $v_D > v_c$, the material is trivial (positive band gap) and $\eta = 0$, while $v_D < v_c$, the material is topological (negative band gap) and $\eta = 1$. In other words, we are able to determine experimentally the topological index corresponding to the topological character of a Dirac material satisfying a BHZ Hamiltonian via its bulk band properties. This is also confirmed by another work performing magneto-transport experiment on the same $\text{Pb}_{1-x}\text{Sn}_x\text{Se}$ samples [8]. Our approach can be thus argued to be more or less valid for several other systems that exhibit a topological phase transition and can be described using a BHZ-like Hamiltonian.

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A16: Magnetic and Semiconductor / 598

Shielding the Earth Magnetic Field using Spherical Coils

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The Jiangmen Underground Neutrino Observatory (JUNO) is a neutrino experiment consisting of 2 systems; central detector (CD) and veto system. The CD is composed of thousands of photomultiplier tubes (PMTs) used to detect light signals from neutrino induced interactions with liquid scintillator inside the CD. Another set of PMTs is used as water Cherenkov detector, together with muon top tracker forming the veto system for background rejection. However, the PMTs' efficiency decreases when they are used in magnetic field. At JUNO's construction site, the Earth Magnetic Field (EMF) is approximately 0.45 G. Therefore, the PMTs of JUNO detector are necessary to be shielded from the EMF.

This work aims to design current-carrying coils that generate magnetic field in the opposite direction to the EMF, thus, the two fields tend to cancel each other. We found that the magnetic field generated

by the 32 circular coils forming a sphere of diameter 43.5 m can reduce the residual magnetic field to be lower than 10% of the EMF at the CD region and less than 20% at the veto region. Moreover, considering the secular change of the EMF's inclination angle of approximately 2.87° over the 20 years of its operation, the coils can maintain the residual magnetic field both in the CD and the veto regions to be less than 10% and 20%, respectively.

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EMF Shielding of One Set of Coils and Shielding with Installation Errors

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Jiangmen Undergroud Neutrino Observatory (JUNO) is a reactor antineutrino experiment with the main purpose for determining the neutrino mass hierarchy by precisely measuring the energy spectrum of nuclear reactor electron antineutrinos at a distance of ~53 kilometers from the reactors (Yangjiang and Taishan nuclear power plants) in a 700-m-deep-underground to reduce cosmogenic muon flux. The JUNO consists of a central detector (CD) of 20 kiloton LAB based liquid scintillator at the center, surrounded by a water pool, muon veto and approximately 18,000 20" and 36,000 3" photomultiplier tubes (PMTs) on CD truss, 2,000 20" PMTs on the wall and bottom of the pool. These PMTs are extremely light sensitive detectors in the ultraviolet, visible, and near-infrared ranges of the electromagnetic spectrum. The PMT is very sensitive to external magnetic fields. Thus, The earth magnetic field (EMF) passing through the PMTs without any shielding would largely reduce the efficiency of the PMTs. In order to reduce EMF inside the detector, JUNO has been planing to use the DC coils for shielding EMF in PMTs region for decreasing the Earth's geomagnetic field at Jiangmen and aims to get the residual intensity to less than 10 % on PMT areas which EMF at JUNO reactor on x, y, and z axes are 0.37988, -0.01505, and 0.23772 Gauss, respectively.

A16: Magnetic and Semiconductor / 455

Quantum scattering mechanisms in the nonpolar CaZrO₃/SrTiO₃ heterointerface

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The electron mobility data from the nonpolar CaZrO₃/SrTiO₃ heterostructure are analyzed. We proposes the electron scattering mechanism from background impurity (BI) scattering, interface roughness (IR) scattering, electron-electron (EE) scattering and polaron-longitudinal optical (LO) phonon scattering to describe the experimental data. We find that the total mobility based on Matthiessen's rule provides good quantitative agreement to the experimental results. At low temperatures, the mobility is limited by BI and IR scatterings. The increasing of electron density, the scattering limited low-temperature mobility crosses over from the BI scattering to IR scattering. At temperatures between 10 and 250 K, the EE scattering is dominant. At room temperature, the mobility is determined by both EE and polaron-LO phonon scatterings.

A17: Statistical and Theoretical Physics / 592

Ability to damp traffic wave when controlling every cars on the road by FollowerStopper controller.

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A small fluctuation in velocities of the vehicles in a traffic system can cause a traffic jam which travels through the road as a stop-and-go wave. FollowerStopper controller is a strategy used in a self-driving car, designed for damping stop-and-go-wave. The previous study shows that controlling only one car can damp the wave in the whole circuit road. Interestingly, in some values of car densities, we have found that using FollowerStopper on every car on the road cannot damp the stop-and-go wave. In this article, we consider the effect of the density on the ability to damp the wave when using the FollowerStopper on every car. To control the density, we run simulations in a circuit road. And, the ability to damp the wave has been reflected as the standard deviation and average velocity of every car. We carried out the simulations of 24 cars running on a circuit road in different circumferences. Our simulation shows that when desired speed is at 7.00 m/s, traffic wave is completely dissipated while density is under 0.06 cars per meter.

A17: Statistical and Theoretical Physics / 518

An application of the Faddeev-Jackiw canonical analysis to Generalization of the Proca field

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We are interested in the generalization of the Proca field. In this work, we want to check that this system is a constrained system. Moreover, we want to check the number of degrees of freedom. We use the Faddeev-Jackiw method which is one of the techniques used for analyzing the constrained system. The result of this work shows that the system is a constrained system with 3 degrees of freedom.

A17: Statistical and Theoretical Physics / 433

Shape sequence of rope coiling on a rotating plane

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Rope fed uniformly from the height exhibits a perfectly circular coiling on a static plane. Introducing the rotation to the plane breaks the rotational symmetry of circle which gives rise to a variety of the more ordered patterns. For sufficiently fast feeding velocity v the coiling shape laying on a rotating plane is a hypotrochoid, namely a closed curve with exterior loops, when plane rotates slowly with low frequency f_0 . As f_0 increases, the number of exterior loops decreases and the shape

eventually turns to an epitrochoid, namely a closed curve with interior loops. The hypotrochoid-to-epitrochoid transition associates with a change in the sign of angular momentum. As f_0 increases further, the number of interior loops gradually decreases to zero and the shape thus turns to a circle. Interestingly the circle which is the shape for static plane is restored at fast plane frequency f_0 , rather than at slow plane frequency f_0 as our intuition would suggest. To elucidate the underlying principles, all the experimentally observed shapes, i.e. hypotrochoid, epitrochoid, and circle, are unified by a geometrical description. The key parameter which controls the shape is the ratio of the circumference velocity of plane relative to the feeding velocity, namely $2\pi f_0 R/v$ where R denotes the radius of the shape. The feeding velocity-plane frequency phase diagram is presented.

A17: Statistical and Theoretical Physics / 420

Van der Waals interaction between anisotropic topological insulator slabs

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Van der Waals (vdW) interactions are prevalent in Nature and account for diverse natural phenomena, such as the flocculation of colloids and the adhesion of geckos to walls. Between similar dielectric materials such interactions are typically attractive and give rise to the problem of stiction and non-contact friction in micro and nano electro-mechanical systems, thus it is of importance to find possibilities of overcoming such stiction and friction. In the seminar we consider the vdW interaction between topological insulators, which are materials that exhibit “axion electrodynamics”, for which an electric field can give rise to magnetic polarization and a magnetic field can also give rise to electric polarization. For the case of dielectrically anisotropic topological insulators, we examine how such electrodynamics can give rise to the possibility of repulsive vdW forces and a reduction of frictional torque.

A17: Statistical and Theoretical Physics / 786

Equation of State for a Market: A Thermodynamical Paradigm of Microeconomics

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Considering equilibrium thermodynamics- the thermostatics, foundation of the paradigms are the equation of state (EoS) and four postulate laws of thermodynamics. We investigate nature of EoS and these laws and we propose a paradigm in analogous to thermostatics in expressing EoS for a microeconomics system that is a market. This speculation is a first step to the whole and overall pictures of thermodynamical paradigm of microeconomics.

A17: Statistical and Theoretical Physics / 621

Inverted Anharmonic Oscillator Model for Distribution of Financial Returns

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We construct a quantum-mechanical model to explain the distribution of financial returns in a stock market. By combining a critical phenomenon effect in the form of a power law and the Schrodinger equation, we derive that an appropriate potential of the financial returns is given by a time-dependent inverted anharmonic oscillator, whose coefficients depend on the critical time and critical exponent, which are empirically obtained from the Stock Exchange of Thailand (SET) from 1992 to 1994, during the critical phase of the Asian Financial Crisis. With the derived potential, we simulate the dynamics of returns as a function of time by employing the time-dependent variational method and the fourth-order Runge-Kutta method. Then we compute key characteristics of the return distribution such as variance, skewness, and kurtosis and compare them with real financial data from SET. The results are found that the mean return is higher than that from SET data, but the variance, skewness and the kurtosis show good agreement. The positive skewness indicates financial returns are not symmetric during that time, and that traders are more likely to lose their money on the investment. The kurtosis fluctuates around the value of 3, implying that the distribution is not normal.

A17: Statistical and Theoretical Physics / 574

Effects of Global and Local Rewiring on SIS Epidemic Adaptive Networks

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Adaptive epidemic network is generally driven by two main processes: (1) infection-recovery process that changes the states of the nodes, and (2) rewiring process that modifies the topology of the network. We consider an adaptive susceptible-infected-susceptible (SIS) epidemic on a network. In this work, a link is rewired randomly to a chosen susceptible node according to a prescribed global or local rewiring method. In the global rewiring case, a susceptible node could break the link with its infected neighbour to form a new link with another susceptible in the graph. In this rewiring mechanism, the node must know health status of every other node in the network in order to rewire. This is however impractical in real life because the knowledge is only limited to a certain neighbouring group of nodes surrounding a given point. We propose a more realistic rewiring method called the local rewiring method, where a new link is limited to join a susceptible within a neighbouring distance. We investigate the impact of local versus global rewiring on an epidemic network. A new disease prevention behaviour emerges as a result.

A1: Biological / 803

Measuring Photosynthesis of Oxygenic and Anoxygenic Photosynthetic Organisms using Pulse Amplitude Modulation (PAM) Fluorometry

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Oxygenic photosynthesis can easily be measured using O₂ or CO₂ gas exchange, oxygen electrodes, Winkler titration and ¹⁴C₂O₂-fixation and by PAM (Pulse Amplitude Modulation) fluorometry. PAM estimates the photosynthetic electron transport rate (ETR) by measuring fluorescence of chlorophyll (Chl) *a* (> 700 nm) induced by blue (Soret, Q_X) band or red light (Q_Y) band. Photosynthetic rates are much less readily measurable in anoxygenic photosynthesis. Anoxygenic photosynthetic bacteria (APB) do not use water as an electron source and are typically photoheterotrophic rather than photoautotrophic and so ¹⁴C₂O₂ fixation is a misleading estimate of photosynthetic electron transport in APB photosynthesis. Most use bacteriochlorophyll (BChl) *a* as their primary photosynthetic pigment. *In vivo* BChl *a* has a Soret band very similar to Chl *a* but its Q_Y bands are in the infrared and fluorescence is at > 800 nm. Blue-diode-based PAM can be used to measure the ETR in purple non-sulphur anoxygenic photobacteria, such as *Afifella marina* and *Rhodospirillum rubrum* and purple sulphur bacteria such as *Thermochromatium tepidum* because their RC-2 type BChl *a* complexes have variable fluorescence similar to PSII. Conventional blue-diode PAM cannot readily distinguish oxygenic and anoxygenic photosynthesis in situations such as sewage ponds. We describe the development of two new types of PAM machines: one that only measures oxygenic photosynthesis and the other only measures anoxygenic photosynthesis enabling estimations of both photosynthetic activities in environmental samples. Some types of APB have RC-1 type of photosynthesis that cannot be measured using PAM methods.

A1: Biological / 648

A Study of *Carteria* sp. Cell Electrical Lysis in Straight and Tapered Microfluidic Systems

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Electrical cell lysis is one of the most efficient techniques in cell analysis in extracting intracellular components for further use or examination. Cells are exposed to high electric field strength that can rupture cell membrane due to nano-size pores creation. Thanks to microfabrication technology, electrodes can be materialized in close proximity to each other leading to high electric field strength with low applied voltage. In this study, two microfluidic systems were designed: straight and tapered systems. The straight channel was chosen due to the ease of fabrication, while the tapered channel was picked since it intensifies electric field strength in the tapered area. Finite element method was used to simulate electric field distribution inside the microfluidic systems and transmembrane potential (TMP) across membrane. In the experiment, green algae *Carteria* sp. which contains large amount of lipid was used in performing microfluidic electrical cell lysis. For 30 nm thick gold planar electrodes with 110 μm spacing fabrication, the simulated TMPs produced in both microfluidic systems exceed 0.2 V which is a threshold potential cell membrane destruction when applying 34 V_{p-p}, 1000 Hz AC voltage. However, *Carteria* sp. cells were only successfully lysed in straight microfluidic system. Although electric field in tapered region is higher than that of the straight microfluidic system, the cells were washed out of the tapered region due to electrohydrodynamic effects.

A1: Biological / 609

Weaver ants demonstrate the adaptive behavior under stress

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In a colony, ants demonstrate their intelligence through complex patterns and collective behaviors which are attributed from a self-organization of individual ant. Ants expressed a wide variety of adaptive intelligences such as creating the route or bridge for foraging, managing a group behavior to escape from dangerous situations without jamming, etc. Here, we develop an experimental platform to observe weaver ants, *Oecophylla smaragdina*, making decision under both normal and stressful circumstances. By analyzing ant's motion under a high-speed camera and our in-house image processing script in MATLAB, we extract individual trajectories of weaver ants and their corresponding physical parameters. Our preliminary results show that weaver ants possess adaptive behaviors through the events which observed from ant's trajectories and speed under the dangerous substance.

A1: Biological / 584

Protein functional motifs: A random matrix approach

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Random matrix theory (RMT), which was formulated 50 years ago, has a wide application in modeling and understanding the diverse areas of research including nuclear physics, disordered systems, information theory, string theory, statistical physics, biological sciences, finance, social systems. In the current work, we use the tools from the random matrix theory to understand the structural and functional organization of a protein family. The method is based on the the random matrix theory which uses various amino acid physiochemical properties along with the multiple sequence alignment data to detect the functional and structural sites and motifs within a protein family. The method is successfully applied to various protein families including the beta-lactamase, serine protease, HSP70, G-proten, HTH1 family etc. In this method a protein sequence is represented as a multi-dimensional time series, which makes it possible to compare the evolutionary distance between the protein sequences based on the physiochemical properties. This gives an easy, fast and informative way to compare different protein sequences using the physiochemical properties. The entropic measures shows that during the evolutionary history of the protein family, it is the certain physiochemical properties that are conserved rather than the type of amino acids. For each physiochemical property, the correlation matrix between positions is calculated, while using an ensemble of Wishart matrices from the random matrix theory for the noise estimation and information filtering. The spectral properties of correlation matrices are calculated and compared with the analytical results for the Wishart matrices. It is shown that the distribution of the eigenvalues outside the random matrix bound deviates significantly from the eigenvalues distribution for Wishart matrices. These eigenvalues and corresponding eigenvectors contains significant information and can determine the structure and functional motifs within the protein family. For proteins, it is found that the eigenvector corresponding to the small eigenvalues are more informative as compared to the large eigenvalues. These small eigenvectors can group positions into sectors with well defined structural and functional role.

A1: Biological / 556

Control Theory for HIV Dynamics: Sliding Mode Control in Antiviral Drug Therapy

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We study the dynamics of human immunodeficiency virus (HIV) infection under HIV antiviral drug therapy. In sense of control theory, the drug efficiency is treated as an controller. In this paper, we reduce the nonlinear terms and reconstruct problem as mathematical model in control system. The sliding mode control (SMC) is applied to control contact rate between CD4+ T lymphocyte (CD4+ T-cell) and HIV. A switching controller is investigated to establish asymptotically stability of the sliding surface as desired. Finally we illustrate simulation results of CD4+ T-cells, infected T-cells, Viral load and control action.

A2: Phys Ed, Plasma, and Nuclear Fusion / 470

Machine Learning system mimicking student's choice in Particle Data Analysis lab activity

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In Particle Data Analysis lab activity, aimed at undergraduate and high school students, the student is tasked with classifying collision events which contain two muons decaying from J/ψ meson. The activity provides 2000 collision events from CMS detector, selected by CMS Outreach community. However, classifying 2000 collision events by hand can be a tedious task for any human, so a smaller subset of collision events are usually used in the activity to save time. We built a machine learning classifier which mimic the student's classification based on a subset of collision events handed to the student, using some information from data in corresponding collision event. The information used in this system is part of muon trajectory, extracted from files suited for CMS event viewer on the internet, as well as the four-momentum of both muons, available from the same source. With this system, students can input a subset of graded events into the system, and the system will be able to illustrate the results if the student worked on all 2000 collision events using his/her logic. Users can download the code from our repository and follow easy instructions to replicate this activity.

A2: Phys Ed, Plasma, and Nuclear Fusion / 456

An activity sheet for teaching double-slit interference

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This study aimed to enhance students' understanding in double-slit interference; especially the optical path difference. An alternative teaching tool called 'Activity Sheet' was developed and applied

to the introductory physics class at Mahidol University in academic year 2016. The activity sheet contains a diagram of the double slit with two transparent strips. The sinusoidal wave pattern together with a ray of light printed on the strip was used to represent the light wave coming out of the source. Each strip is pinned at the point source and can be rotated around the pinned point. The results from the test indicate that most students realized the importance of the path difference after they had learnt with the activity sheet. In addition, most students from the interview said that learning with activity sheet helped them understand double-slit interference better and made it easier to visualize the superposition of interfering light waves.

A2: Phys Ed, Plasma, and Nuclear Fusion / 509

Fluid Density and Impact Cavity Formation

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As part of the KVIS-ISB Student Research Collaboration Program, we collaborated on designing, conducting, and analyzing research into the formation of an impact cavity when a steel ball is dropped into a liquid. The relationships between the characteristics of impact cavity formation and the density of the liquid into which the ball is dropped were investigated. Densities ranging from 0.98 g/cc to 1.63 g/cc were tested. A high-speed camera was used to record cavity formation and decay. The results showed that cavity volume, depth and diameter are all independent of density. For unknown reasons, the cavities formed at densities of 1.34 g/cc and 1.45 g/cc were significantly smaller and qualitatively different. Participation in the program increased our research and collaboration skills, critical thinking skills, and problem-solving abilities. We also benefited from increased understanding of the rigor of the research and publishing process.

NOTE

KVIS-ISB Student Research Collaboration Program Presentation

Kamnoetvidya Science Academy (KVIS) and International School Bangkok (ISB) have established the KVIS-ISB Student Research Collaboration (SRC) Program to develop students' skills in experimental research and the journal review and publishing process. This presentation describes the published work of one group of program participants, along with their perspectives on the KVIS-ISB SRC Program.

A2: Phys Ed, Plasma, and Nuclear Fusion / 508

Paddle Angle and Ball Spin in Table Tennis

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Our group in the KVIS-ISB Student Research Collaboration Program investigated how the impact angle of a table tennis paddle affected the resulting spin of the ball. A table tennis ball struck a paddle at angles ranging from 10° to 80°. Using high-speed video analysis, the angular velocity was measured for each impact angle. It was found that the sine of the impact angle was proportional to the angular velocity of the ball after impact. The proportionality constant was found to be 120

radians per second, in agreement with the theoretical value of 113 ± 10 radians per second. This was our first experience of research collaboration outside our schools and our first experience of the rigor of the research and publishing process. We believe that the program has improved our abilities in problem-solving, critical thinking, collaboration, and experimental design.

NOTE

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A2: Phys Ed, Plasma, and Nuclear Fusion / 463

Investigation of Cold Atmospheric Plasma induce Apoptosis in Cancer Cell

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Nowadays, the techniques that use for cancer treatment such as chemotherapy and radiotherapy have deficiency and are not selective for killing only cancer cell. Cold atmospheric pressure plasma with dielectric barrier discharge (DBD) is one of the most important biomedical applications in cancer therapy. It can be applied to living cells and tissues and generated large amount of H₂O₂ and NO_x radicals to anti-cancer. The purpose of this study was to develop mini-DBD air plasma device as the tool for apoptotic cell death in SW480 colorectal cancer cell. The coaxial mini-DBD was driven by kHz DC pulse and generated filamentary plasma with 1 mm length and 2 mm diameter. Plasma powers that modulated by pulse width modulation were carried out by I-V characteristic curves.

A2: Phys Ed, Plasma, and Nuclear Fusion / 755

Investigation of Half-Ring Vortices Generated by Half-Submerged Thin Circular Plate Using Digital Particle Image Velocimetry Method

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A half-ring vortex near the free surface interface of water can be generated by dragging a half-submerged thin circular plate in the fluid and quickly pulling it out. This results in faster moving water in front of the plate rolling over the slower water next to the plate and creating a vortex. This vortex tends to preserve its momentum which results in the vortex continually spinning and moving

in the dragging direction. To investigate the ring's motions, the Digital Particle Image Velocimetry (DPIV) method is used to study the flow of the vortex. Glitter is used as tracking particles which follow the flow of the water. The relationships between the radii of the ring and the plate as well as the dragging and vortex speeds are derived. In addition, the vortex size and speed appear to not be constant over time. It can be deduced experimentally that this half-ring vortex behaves similarly to a full vortex ring generated by the motion of a fully submerged circular plate.

A2: Phys Ed, Plasma, and Nuclear Fusion / 647

Surface Water Wave Topography Construction using Free Surface Synthetic Schlieren Method for Ripple Tank Wave Phenomena Demonstration

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The ripple tank is a popular water wave phenomena demonstration tool for secondary school students. The projected wave images are observed in bright - dark patterns on a screen. This tool, however, falls short in presenting the amplitude of the waves which is another important parameter in explaining the wave phenomena. The free surface synthetic schlieren (FS-SS) method presents an immense technical tool for solving this problem. FS-SS is an optical method based on light refraction in determining the surface gradient field from the motion of a random dot pattern when the water surface is perturbed. The surface height of the wave is constructed using the inverse gradient operation on the displacement gradient field of the random dot pattern. In this work, Wave propagation, reflection, diffraction, and interference pattern surface construction were performed to visualize wave phenomena in 3D.

A2: Phys Ed, Plasma, and Nuclear Fusion / 767

Number of Blades of Rotating Blades Effected on the Nucleate Boiling Heat Transfer Enhancement of distilled water

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This study examined the nucleate pool boiling heat transfer characteristics of distilled water at atmospheric pressure on a horizontal circular plate with rotating blades installed above a heating surface. The experiments were performed to explore the effects of number of blades as well as the visualization of pool boiling phenomena on nucleate boiling characteristics and the heat transfer coefficient. The rotating blades were made from copper material, with the number of blade of 2, 3 and 4 blades, a diameter of 30 mm, a blade angle of 90°, a core of 5 mm, and a length of 50 mm. The study examined the effect of a varying the number of blade on the pool boiling heat transfer characteristics, the heat

transfer coefficient and the pool boiling phenomenon. The results showed that, the number of blade of 4 blades yielded a higher heat transfer coefficient than the number of blade of 2 and 3 blades, because the increased number of blade provided more chance for the bubbles to strike the rotating blades. Hence, the rotating blades did create a commotion of the working fluid above the heating surface. High speed camera frames were captured using an Aos Promon Studio at 500 fps at the heat fluxes about 160-610 kW/m² to identify the location of bubble nucleation for each configuration, and to predict the liquid supply pathways. The photographic observations show that, the pool boiling pattern with the heat flux value about 160 kW/m² was the isolated bubble regime, and with the heat flux value about 610 kW/m² was the column regime.

A2: Phys Ed, Plasma, and Nuclear Fusion / 765

EFFECT OF ROTATING BLADES INSTALLED ABOVE THE HEATING SURFACE ON THE NUCLEATE BOILING HEAT TRANSFER ENHANCEMENT

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A study of nucleate pool boiling phenomenon of distilled water on a copper heating surface with rotating blades installed above the heating surface was experimentally investigated. The rotating blades were made from Polylactic acid (PLA), with the number of blade of 4 blades, a diameter of 30 mm, a length of 50 mm, a blade angle of 90°, and a core of 5 mm. The study examined the effect of a varying distance between the heating surfaces and rotating blades (LSB) on the pool boiling heat transfer coefficient. The results show that, the LSB of 5 mm yielded a higher heat transfer coefficient than the LSB of 15 and 25 mm. This is because the decreased LSB provided more chance for the bubbles to strike the rotating blades. Hence, the rotating blades did create a disturbance of the working fluid over the heating surface.

A2: Phys Ed, Plasma, and Nuclear Fusion / 653

Evaluation of Thai students and teacher's attitudes in physics using Colorado Learning Attitudes about Science Survey (CLASS)

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The Colorado learning Attitudes about Science Survey, CLASS, has been used as a tool to measure respondents' beliefs or attitudes about physics and how they learn physics. It is composed of 42 Likert scale (strongly disagree to strongly agree) type questions which is classified into 8 categories, which are real world connections, conceptual connections, personal interest, sense making, applied conceptual understanding, problem solving general, problem solving confidence and problem solving sophistication. In this study, we asked 196 high school physics teachers and 211 students from 195 secondary schools in Thailand to respond on this survey along with a 6-open-ended-question survey. In this work, we focus on two topics: "What is the difficulty in learning/teaching physics?" and "What is the goal in learning/teaching physics?". We found that physics teachers agree with the

experts in most categories, except conceptual connection, applied conceptual understanding and problem solving sophistication. While students tend to disagree with the experts in both conceptual categories and all three categories in problem solving. We then compare teachers' to students' responses from these two open-ended questions. On the difficulty aspect: 19% of students believe that difficulty in learning physics is due to incomprehension of physics concept. While 43% of teachers thought that difficulty in teaching physics is because of insufficiency of mathematics background. On the goals aspect, 37% of students aim to enter the university; while 50% of teachers target on helping student understand physics.

A2: Phys Ed, Plasma, and Nuclear Fusion / 681

Development of Arduino-based Logic Gate Training Kit

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Abstract: In this work, we develop a robust, and portable Arduino-based logic gate training kit. It was designed to use with an electronic engineering undergraduate university course instead of using fixed laboratory experimental apparatus. The training kit provides students with the necessary laboratory tool in order to learn a fundamental concept of logic gates operation regarding six logic gates; AND, NAND, OR, NOR, XOR, and XNOR. An ATmega 2560 Arduino board was used, including with a two 3.7V battery for power supply, 2-input or 3-input selectors, and jumpers to connect the supply with desired logic input, to develop the training kit. Therefore, the training kit can be used to explore the output of the 2-input and 3-input basic logic functions. The output of each logic function can be detected by the LED light (Green = high output, Orange = low output). Students can see directly the output logic through LED when they select the desired input logic 1 or 0. The logic gate training kit is capable to use simultaneously while students are in the lecture time. Theoretical calculations are compared with direct observations from the logic gate training kit via the learning activities in the classroom. This provides the active learning environment to the students with a more flexible (Compact Set-up), experimental based learning experience than traditional classroom-based teaching.

Keywords: Educational Aid, Arduino-based, Logic Gate Training Kit, Undergraduate Level, Logic Gate Operation

A2: Phys Ed, Plasma, and Nuclear Fusion / 652

Problem based learning: How can electricity cause the house fire?

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The aim of this study was to fine the result of Problem Based Learning with an activity in the topic of "How can electricity cause the house fire?" The concept of this question was separated into

3 parts; short circuit cause the overload current, a large amount of current can cause high heat, and high heat over the Ignition Temperature makes the material on fire. There were 62, 7th grade students participate in this study. Students were provided a question and asked to design their own experiment as groups. The question was "How can you ignite the fire with limited material?". The provided materials are rubber band, paper clip, AA battery, rope, gum and cotton pad. Presentation was taken place after the design session. Students had been doing the experiment as they design and find out if any material can use together to light the fire up. Some of them got stuck because of their design were not work. After that, teacher gave students a hint that they could use only Aluminum paper and battery to light the fire, the different is only the shape of the aluminum paper. Students did the experiment until they get the result. Teacher asked students to compare the Aluminum paper and the Wire. The activity took around 100 minutes to finish. Post-test was given to students after the class as an open-ended question to see if student can link the activity to a real-life situation. The question was "How can electricity cause the house fire?". From this activity, the result from qualitative data shows that the activity cannot make student understand the concepts behind the activity. 3.22% of students can get the first part of concept, 6.45% for the second part, and 29.03% of the third part. Moreover, there are some common misconception that also found. 20.96% of students have misconception that current in the circuit can be stored at a point and 16.13% of students think that current come from both terminal of battery and clash in the middle. In next study, this activity should modify the instruction and question that should provide more along the activity to help student to learn better about all three parts of the concepts.

A2: Phys Ed, Plasma, and Nuclear Fusion / 680

Low-cost demonstration kit for the blood-color lunar eclipse formation

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The red or blood-color Moon is the one characteristic of Lunar eclipse phenomena. This rare event occurs when the moon orbits into the Earth's shadow. In fact, the dust, ashes or gas in Earth's atmosphere scatter the short wavelength of sunlight (blueish light). But they allow the longer wavelength (reddish light) travel through the atmosphere to space and reflect the Lunar surface back. Thus, the observers on Earth see the Moon turns red or dark red. The Physics books and previous articles usually describe how the Moon turns red by using diagrams. In this article, we design the demonstration kit that does not show only umbra and penumbra of the Earth's shadow. The kit can be demonstrated how short wavelength light scatters by manipulating a basic material (e.g., ground coffee beans) as dust or ashes in Earth's atmosphere.

A2: Phys Ed, Plasma, and Nuclear Fusion / 624

Determining the degree to which a hen's egg is cooked by boiling

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Eggs are very good sources of low-cost and high quality protein. They are delicious and can be eaten well cooked, medium-cooked or raw. The objectives of this study were to define and determine the degree to which a hen's egg is cooked by boiling without breaking its shell. Assuming that an egg has a radial symmetry and a constant density, the moment of inertia is proportional to its mass and square of its radius. As the eggs are heated, the protein inside them turns harder. That affects the apparent moment of inertia of an egg. The torsion pendulum was used to measure rotational motion of an egg. Two springs were attached to the side of the egg holder to create restoring torque, hence oscillation. A photo gate together with a 10-slot disc was used to detect the rotational motion of the egg. The period of the oscillation was recorded. The results show that the moment of inertia of raw eggs and hard boiled eggs are different and both are proportional to MR^2 . The ratio of MR^2 of liquid core (uncooked part) to the whole egg has a linear relationship to the $\frac{T^2 - T_0^2}{MR^2}$ and this value can be used to determine the degree to which an egg is cooked.

A2: Phys Ed, Plasma, and Nuclear Fusion / 591

Analysis of Understanding in the Speed of an Electromagnetic Waves and in the Principle of Refraction: a Case Study of KMUTT (Ratchaburi) Engineering Freshmen

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Learning achievement in fundamental electromagnetism performed by 110 engineering freshmen, enrolled in 2017 at King Mongkut's University of Technology Thonburi (Ratchaburi), is presented. Activities for the class had not only been conducted by traditional lecture, but also with an integrated project assignment. Two key concepts in physics, the speed of an electromagnetic (EM) wave and the principle of refraction, delivered to students by two different teaching and learning are selected for comparison. Preliminary results are analyzed from students' score in the final examination. Some of students' misconceptions are found in both selected topics. From the comparison, the teaching and learning methods through the project activity, together with the lecture, seem to yield a great number of well-understood students than those through the lecture alone. Further investigation is also discussed based on rank of students' score. The findings in this paper stress an important of well-designed projects that complement the traditional lectures in classroom.

A2: Phys Ed, Plasma, and Nuclear Fusion / 565

An equipment design to verify Boyle's law

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A portable and user-friendly tool was designed and built to measure pressure and temperature of the air with variable volumes. An Arduino board programmed to read pressure and temperature was installed in a closed container consisting of a syringe connected to a tightly sealed box. The volume of the air in the system can be altered by moving the piston. By considering the air as an

A2: Phys Ed, Plasma, and Nuclear Fusion / 497**Drag Force on Cars in Flooded Streets****Authors:** Chanon Hasuwannakit¹ ; Nico Angelo Millana² ; Seksan Yoadsanit¹¹ *Kamnoetvidya Science Academy*² *International School Bangkok***Corresponding Authors:** chanonha@gmail.com, 16366@students.isb.ac.th, 6000208@kvis.ac.th

As our part of the KVIS-ISB Student Research Collaboration Program we looked at how the drag force on cars driving in flooded streets depends on velocity and water depth. The relationship between the drag force acting on a car and the depth of the water that the car is driving through was investigated for a range of velocities. A model car was given a quick push along a track through water with depths ranging from 0.0 cm to 4.0 cm and allowed to decelerate on its own. It was shown that, for a given velocity, the drag force increased with increasing depths up to 75% of the wheels' radius. Above that depth, the drag force remained constant. The drag force was found to be proportional to the velocity of the car for all depths. The SRC program exposed us to the rigorous process of designing, conducting, and publishing scientific research and helped develop critical thinking and problem-solving skills as well as creativity and research skills.

NOTE

KVIS-ISB Student Research Collaboration Program Presentation

Kamnoetvidya Science Academy (KVIS) and International School Bangkok (ISB) have established the KVIS-ISB Student Research Collaboration (SRC) Program to develop students' skills in experimental research and the journal review and publishing process. This presentation describes the published work of one group of program participants, along with their perspectives on the KVIS-ISB SRC Program.

A2: Phys Ed, Plasma, and Nuclear Fusion / 449**KVIS-ISB Student Research Collaboration Program****Authors:** Min Medhisuwakul¹ ; Jonathan Eales²¹ *Kamnoetvidya Science Academy*² *International School Bangkok***Corresponding Authors:** min.m@kvis.ac.th, jonathae@isb.ac.th

Kamnoetvidya Science Academy (KVIS) was founded by PTT to educate high-ability students to become future researchers and scientists, with a mission to cultivate creative thinking to drive future innovation. This is in line with the Thai Ministry of Education's stated aim of developing students' scientific inquiry and analytical thinking skills as part of the 4.0 goal to establish Thailand as a center of research and innovation.

A student inquiry program in physics has been developed and maintained at International School Bangkok (ISB) for over 10 years, with successful projects being reviewed and published in the International Scholastic Journal of Science (isjos.org). Drawing on this experience the KVIS-ISB Student Research Collaboration (SRC) program was established in 2017 as a way in which KVIS students could begin to develop research and publishing skills, and ISB physics students could deepen their experience of research, collaboration, and publishing. The initial SRC program paired ISB grade 12 students with KVIS grade 10 students to collaborate on joint projects. Three weekends were spent designing procedures, taking measurements and drafting papers for review by ISJOS.

KVIS students reported that they benefited from the program through increased understanding of the process of research and had gained confidence in their ability to participate as members of the

scientific community. ISB students welcomed the opportunity to collaborate and to further develop their skills in research and publishing.

The authors will continue to develop and expand the SRC program, and are interested in helping to establish similar programs with other secondary schools in Thailand.

A3: Optics and Photonics / 727

Characteristics of fork fringes formed by two obliquely-incident vortex beams with different topological charge numbers

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Optical vortex is a mode of light whose phase distribution varies as $\exp(il\phi)$, where m is called the topological charge of the vortex and ϕ is an azimuthal angle in the plane perpendicular to the propagating direction. The vortex beam of charge l carries an orbital angular momentum of $l\hbar$ and has its application in manipulating micrometer-sized particles. A common method to detect topological charges of optical vortices is interference with a tilted Gaussian beam. In this work, we study the interference pattern of two obliquely-incident vortex beams with different topological charges, created by spatial light modulators (SLMs). We find fork-like fringes similar to those observed from the interference between a vortex and a Gaussian beam. The fringe difference between the top and the bottom of the fork equals the difference between the topological charges of the two vortices, as predicted by the theory. When the topological charges are the same and the fork pattern disappears. The tilted angle between the vortex beams affects the fringe spacing: the larger the tilt angle the smaller the fringe spacing. When the tilt angle is zero, the fringes disappear and the interference patterns become radial from the defect center. We suggest the result can be used to detect a topological charge of a vortex beam.

A3: Optics and Photonics / 724

Characteristics of fork fringes formed by two obliquely-incident vortex beams with different topological charge numbers

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Optical vortex is a mode of light whose phase distribution varies as $\exp(il\phi)$, where m is called the topological charge of the vortex and ϕ is an azimuthal angle in the plane perpendicular to the propagating direction. The vortex beam of charge l carries an orbital angular momentum of $l\hbar$ and has its application in manipulating micrometer-sized particles. A common method to detect topological charges of optical vortices is interference with a tilted Gaussian beam. In this work, we study the interference pattern of two obliquely-incident vortex beams with different topological charges, created by spatial light modulators (SLMs). We find fork-like fringes similar to those observed from the interference between a vortex and a Gaussian beam. The fringe difference between the top and the bottom of the fork equals the difference between the topological charges of the two vortices, as predicted by the theory. When the topological charges are the same and the fork pattern disappears. The tilted angle between the vortex beams affects the fringe spacing: the larger the tilt angle

the smaller the fringe spacing. When the tilt angle is zero, the fringes disappear and the interference patterns become radial from the defect center. We suggest the result can be used to detect a topological charge of a vortex beam.

A3: Optics and Photonics / 769

Python-based Automatic Control System for Frequency-Response Measurement of the Quartz Tuning Fork

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The quartz tuning forks (QTF) is a high quality factor (Q-factor) mechanical resonator and therefore high sensitivity to the surrounding environment. Owing to the piezoelectricity of the quartz, the compact driving system can be achieved by attached electrodes on the QTF. Therefore the QTF, attached with a sharp optical fiber or tungsten tip, is widely utilized as a shear force sensing probe in NSOM or AFM. The readout electrical signal of the scanning QTF probe over the sample's surface and the feedback control system of the probe's height render the topographical image of the sample. The sensitivity and response time of the feedback system is specified by the Q-factor which can be determined from the frequency response curve of the QTF.

Here, we present an automatic control system for frequency-response measurement of the QTF. The frequency sweep of the driving signal and the signal readout of the QTF are controlled automatically by a python-based software, developed in this research. The software provides GUI for users to choose the number of data points for the frequency sweep, the frequency range and the amplitude of the driving signal. Additionally, the frequency response curve and the Q-factor calculation can be displayed after the end of the frequency sweep.

A3: Optics and Photonics / 696

Effect of SILAR Techniques on Photovoltaic Properties of PbS Quantum Dot Sensitized Solar Cells

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PbS quantum dots (QDs) have been received attention as a photosensitizer for quantum dot sensitized solar cells (QDSSCs) due to their narrow band gaps, quantum size effect, and multiple exciton generation (MEG). In this work, we prepared PbS QDSSCs by successive ionic layer adsorption and reaction method (SILAR) with PbS QDs deposited onto titanium dioxide (TiO₂), then the PbS QDs have been investigated the effect of SILAR cycles on photovoltaic properties. The power conversion efficiency (PCE) of the solar cells is dependent on SILAR cycles and an optimal SILAR cycle is two cycles. The PbS QDSSCs achieve the PCE of 1.79% with the photocurrent of 16.39 mA/cm⁻². Moreover, the optical properties were investigated by UV-visible absorption spectroscopy, which reveals a SILAR cycle affecting a band gap of PbS QDs.

A3: Optics and Photonics / 672**Backward third-harmonic pulse generation in a one-dimensional PIM/NIM structure****Authors:** Prathan Buranasiri^{None} ; Surawut Wicharn^{None} ; Witoon Yindeesuk¹¹ *King Mongkut's Institute of Technology Ladkrabang***Corresponding Author:** mayga1@gmail.com

In this work, a set of couple-mode equations for describing a backward third harmonic generation (BTHG) in a one-dimensional periodic structure of positive-index material (PIM) layers and third-order nonlinear negative-index material (NIM) layers is analyzed using multiple-scale method. Due to the negative-index phase matching and band-edge field enhancement the intensities of backward third-harmonic pulse generated from the PIM/NIM periodic structure is increased for 100 time of those generated from a single NIM medium.

A3: Optics and Photonics / 552**The design and development of a foot plantar pressure measuring device based on the mechanically induced long period fiber grating****Author:** Punthep Rattananupong^{None}**Co-author:** Ratchapak Chitaree¹¹ *Assistant Professor Doctor (Asst. Prof. Dr.)***Corresponding Author:** punthep.r@gmail.com

The aim of this study is to design and develop an alternative in-shoe foot plantar pressure measurement based on an optical fiber sensor. The foot plantar pressure distributions from human feet is considered to be important and essential information required by clinicians to plan a proper management on some foot problems of diabetic patients. Advantages of using the optical fiber include the immunity to electromagnetic interference, structural flexibility, light weight and low-cost assembly. The main component of the sensor is the long period fiber grating (LPFG) which is composed of a strand of single mode fiber (SMF, 9/125 μm) with a cut-off wavelength at 800 nm and plastic grooved plates with grating periods less than 1 mm. The gratings with different periods are placed at different regions in a foot platform whereby a patient's fore-foot, mid-foot and hind-foot are supported. The LPFG mechanically induced by the plantar pressure applied from each region can be observed from the resonance wavelength shift as a part of the transmission spectrum from the sensor. The data reveal both magnitude and position where the pressure is applied. Experimental results show that this system has a stable and reliable performance for measuring the foot plantar pressure distribution.

A3: Optics and Photonics / 531**The fabrication and characterization of asymmetric gratings using the optical Talbot effect****Authors:** Thanarwut Photia¹ ; Min Medhisuwakul² ; Wipawee Temnuch¹ ; Sorakrai Srisuphaphon³ ; Sarayut Deachapunya⁴

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We fabricate asymmetric gratings, which have the ratio between the opening window and period or the opening fraction, $f < 0.5$. The gratings were fabricated by using CNC milling machine to engrave a pattern on transparent acrylic sheets. The characterization of the gratings is performed with the optical Talbot effect. The results of the Talbot pattern, as well as the intensity along the longitudinal distance, can apparently identify the opening window and grating period. The grating with the opening window of $23 \mu\text{m}$, period of $100 \mu\text{m}$, and thus the opening fraction of 0.23 can be obtained with our method. This type of grating can be used in many practical applications such as optical spectroscopy.

A4: Plasma and Nuclear Fusion / 459

Plasma Simulations of Small Tokamak in Thailand using Integrated Predictive Modelling Code

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This work uses CRONOS integrated predictive modelling code to simulate ion and electron temperatures of plasma in conditions for a small tokamak to be installed at Thailand Institute of Nuclear technology (TINT), under the collaboration of the Center for Plasma and Nuclear Fusion Technology (CPaF). Fusion reactions can be created in tokamak but each experiment can rather cost a huge budget. So simulations plays important role in developing and predicting plasma profiles and performance. In this work, plasma equilibrium profiles are calculated by Helena module. The plasma transport is modelled using a combination of a neoclassical transport, NCLASS and an anomalous transport model, Mixed Bohm/gyro-Bohm. The boundary condition is set based on simple scaling. It is found that for all simulations, plasmas remain in L-mode because no external heating is given. The plasma is heated solely by Ohmic effect. The electron density is assumed around 10^{-19} m^{-3} at plasma center. Ion and electron temperatures are investigated for effects from variation of engineering parameters such as plasma current, toroidal magnetic field.

A4: Plasma and Nuclear Fusion / 762

Electron Spin Resonance Analysis of γ -induced Free Radicals in Riceberry Rice Grain

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Gamma irradiation has long been serving as one alternative preservation method for food and agriculture products. Initial physical interactions of gamma with biomaterials lead through radical formation, depolymerization, and molecular changes to eventual sterilization, decontamination and preservation. An effective penetration of gamma radiation homogenize the effects throughout the materials. Riceberry rice composes mainly of starch, which has α -D glucopyranose ($C_6H_{12}O_6$ or glucose) as a building block in its polysaccharide network. Follow irradiating rice with Co-60 gammas of a few kilograys, the polysaccharide chains have undergone several changes in their molecular structure, which lead to generation of free radicals. Electron spin resonance (ESR) analysis has shown that quite a few free radicals were formed with different strengths. Their respective Lande's g-values were in the range of 1.9900 – 2.0180. Mechanisms such as hydrogen abstraction on C6 position, an internal hydrogen bonding between the C4 and C6 hydroxyl groups, or formation of primary hydroxyalkyl between C1 and C2 are presumably accounted for the formation of these free radicals.

Keywords: Gamma-ray irradiation, ESR, SEM, riceberry rice, depolymerization, crosslinking

A4: Plasma and Nuclear Fusion / 613

Collimator design for neutron radiography station using Monte Carlo simulation

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In this research, neutrons and gamma rays at the neutron radiography station of Thai Research Reactor, TRR-1/M1, at Thailand Institute of Nuclear Technology (Public Organization) were characterized. The aim was to design an appropriate outer neutron collimator at the neutron radiography station for collimating neutron beam to the radiographic position, by reducing radiation scattering and reducing dose rate around the radiography station. Beam characteristics of 3 different designs of collimators were studied at the reactor power of 1.2 MWth by using Monte Carlo simulation. From the results, the outer collimator assembled from 5.5 cm-thick of borated polyethylene (5% boron) which was covered by 1 cm thick lead and 0.5 cm-thick iron, respectively, and the length of 50 cm could reduce the gamma ray scattering most effectively. Moreover, the neutron fluence at the radiographic position of 100 cm and 140 cm were increased by 22% and 8%, respectively, when compared with the condition without an outer collimator. Therefore, the exposure time and also the dose rate around the radiographic station could be reduced. In the future, the outer collimator will be constructed and will be installed based on this appropriate design.

Keywords: Neutron radiography, Collimator, Borated polyethylene, Radiation scattering, TRR-1/M1

A4: Plasma and Nuclear Fusion / 601

Investigation of L-H Transition Criteria and Pedestal Structure Based on Three-Field Bifurcation Model

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This research aims to study the effects of input sources on $L-H$ transition as well as width and height of pedestal in tokamak fusion plasmas based on three-field bifurcation model. Three transport equations including thermal, particle density and toroidal momentum density are solved simultaneously including residual stress term and convection term, resulting in the prediction of plasma pressure, plasma density and toroidal velocity profiles at steady state. The transport effects include both neo-classical and anomalous transport with velocity shear dependent suppression function. The results show physical profiles of plasma pressure, plasma density and toroidal velocity versus normalized plasma minor radius. The input sources (heat/particle /toroidal force density source) are varied to find the onset of $L-H$ transition by using contour method of input sources. In addition, relation of width and height of the pedestal for all three fields are investigated.

Keyword: bifurcation, pedestal, edge transport barrier

A4: Plasma and Nuclear Fusion / 573

Ozone Conversion for Dielectric Barrier Discharge Plasma using Vitamin C as Intermediate Layer

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Atmospheric plasma such as dielectric barrier discharge(DBD) has ability to eliminate bacteria and fungus by cell wall or cell membrane disruption directly. Ozone(O₃) is obviously created via process of DBD plasma generation and it is very harmful to human if there is more than 0.25 ppm. The objective of this research is to reduce ozone from dielectric barrier discharge plasma through antioxidant intermediate layer. Because vitamin c is a good antioxidant that can protect human from free radicals and vitamin c has a very fast reaction with free radicals. The result show that antioxidant intermediate layer can convert ozone from DBD plasma of area 76 cm² to oxygen by using vitamin c concentration of 500, 1000, and 1500 mg are 33.9%, 42.7%, and 51.1% compare with control, respectively.

A4: Plasma and Nuclear Fusion / 527

Investigation of Bactericidal Effect of an Air Plasma Jet with Mixing Vaporized H_2O_2 on *S. aureus* and *P. aeruginosa*

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The air plasma has been developed as the effective medical instruments due to providing breakthrough solutions to challenging medical problems. Air plasma selectivity and the emerging of reactive oxygen and nitrogen species (RONS) play a key role in numerous biochemical pathways in

living organisms i.e. nitric oxide (NO) contributes to promote wound healing processes, hydroxyl radicals (OH) and ozone (O_3) have been investigated for having a significant antibacterial effect. In this work, we studied the bacterial inactivation effect of air plasma jet on Gram-positive bacteria *Staphylococcus aureus* and Gram-negative bacteria *Pseudomonas aeruginosa* by varying time of treatment. The results indicated that the increase of clear inhibition zones with longer of time of treatment. Furthermore, the bactericidal effect of mixing vaporized 3% hydrogen peroxide (H_2O_2) together with air plasma resulted in higher antimicrobial activity compared with the control group which treated by air plasma only.

Keyword: cold air plasma, reactive oxygen and nitrogen species (RONS), hydrogen peroxide (H_2O_2),

A4: Plasma and Nuclear Fusion / 476

Predictive Simulation of Pellet Injection in a Small Tokamak in Thailand

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Integrated predictive modeling code TASK/TR is used to investigate the impact of pellet injection in Thailand future tokamak. In the core region, plasma profiles are predicted by a combination of the current diffusive ballooning transport model and neoclassical transport. The pellet ablation in the background plasma is described using the neutral gas shielding model with the ∇B drift effects included. Pellets were launched from various directions into ohmic and auxiliary heated plasmas. It is found that the pellet injection can result in the increasing central density and the decreasing temperatures at the edge. Due to ∇B drift effect, launching the pellets from the high-field-side yields deeper penetration depth than the injection from the vertical and low-field-sides of the tokamak. The results suggest that the pellet injection proves to be an efficient method for refueling in tokamaks.

A4: Plasma and Nuclear Fusion / 472

Simulation Study of Plasma Boundary in Thailand Future Tokamak using Two-Points Model

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As Thailand has been preparing to operate a small tokamak, the quantitative information about the plasma in the edge and at the material surface would be insightful for future experimental operation. In this work, we numerically investigate the particle and heat exhausted from the core plasma to the limiter by employing a simple two-points model. It is found that the electron temperature at the limiter surface is in the range of 1-100 eV depending on the particle and heat fluxes from the core. Furthermore the conditions for the plasma detachment are also explored.

A4: Plasma and Nuclear Fusion / 452**Effects of External Heating Schemes and Magnitude on Thailand Tokamak Plasmas**

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Simulations of Thailand tokamak plasmas are carried out using a CRONOS integrated predictive modelling code. The code is designed in a modular structure, consisting of a 1D transport solver with general 2D magnetic equilibria, and including of several heat, particle and impurities transport models as well as heat, particle and momentum sources. In this work, a combination of a mixed Bohm/gyro-Bohm anomalous transport model and an NCLASS neoclassical transport model are used to calculate plasma core diffusivities. The boundary condition of the simulations is taken to be at the top of the pedestal, which is based on an international multi-tokamak scaling. This set of code is used to predict plasma profiles including current density, electron and ion temperatures, etc. A sensitivity analyses on plasma performance of the future Thailand tokamak is performed as external heating scheme, i.e. ICRH, ECRH and LH, and magnitude are varied. It is found that the transport barrier height at plasma edge and central temperatures are found to be sensitive to various parameters such as magnetic field, plasma current and heating schemes. The aim of this study is to identify the optimization point for operation of the tokamak.

A5: Nanoscale and Surface / 634**Hydrophobicity Recovery of Polydimethylsiloxane Treated with Oxygen Plasma and Ion Implantation**

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One of a few disadvantage properties of polymethylsiloxane (PDMS) is its hydrophobicity which can hinder its fluidic applications. Oxygen plasma treatment on PDMS surfaces is a conventional method in rendering them hydrophilic, however hydrophobicity returns within days after treatment. This study proposes oxygen ion implantation at the micrometer scale inside PDMS structures to ensure lasting hydrophilicity. The PDMS slabs were treated with 20 keV oxygen ion with 1×10^{15} ions/cm² fluence and inductively coupled oxygen plasma generated at a power of 28 W and frequency of 13.56 MHz. The chemical composition of the treated PDMS surface was monitored by X-ray photoelectron spectroscopy (XPS) and it was found that oxygen concentration remain high after three days of oxygen plasma treatment on the PDMS. Although the surface oxygen concentration in the oxygen ion implanted PDMS was not as high as that oxygen plasma treated PDMS, the oxygen concentration level was remained higher than that of the untreated PDMS surface for four weeks.

A5: Nanoscale and Surface / 534**Different natures of sub-gap states in 135-CIGS / 112-CIGS and**

112-CIGS / 135-CIGS heterostructures investigated by photoluminescence technique

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CuIn_{1-x}Ga_xSe₂ (112-CIGS) has been proposed as a material for high efficiency thin film solar cells with reliably applicable photovoltaic properties. Higher efficiency devices can be achieved by various surface treatments and are believed to have Cu deficiency at the surface. One of the possible techniques is to have a very thin Cu-depleted surface, e.g. Cu(In_{1-x}Ga_x)₃Se₅ (135-CIGS) layer on top of 112-CIGS layer, thus the heterostructure of 135-CIGS / 112-CIGS is formed. Our previous work show that the photoluminescence (PL) spectra of 135-CIGS with various thicknesses on 112-CIGS (135-CIGS / 112-CIGS) heterostructure are identified as donor-to-acceptor pairs (DAPs) and free (conduction band) -to-bound (acceptor) transitions and show the temperature and excitation power dependence on the PL spectra. On the contrary, when the thin 112-CIGS layer is deposited on top of 135-CIGS (112-CIGS / 135-CIGS), the PL spectra show more pronounced and resolved peaks which are surprisingly independent of temperature and excitation power and significantly distinguishable in its natures observed in those broad emissions of 135-CIGS / 112-CIGS heterostructures. When the thickness of 112-CIGS on 135-CIGS is increased, the red shift in the order of ten meV is noticed in both emission lines of 112-CIGS and 135-CIGS. These results suggest that the strains play more important roles in thinner capping layer and freeze out the temperature and excitation power dependence in the 112-CIGS / 135-CIGS rather than the 135-CIGS / 112-CIGS heterostructures.

A5: Nanoscale and Surface / 688

Synthesis and Characterization of Tin oxide Thin Film for Gas Sensor Applications

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The effects of annealing temperature on the structural and electrical properties of tin dioxide (SnO₂) thin films were systematically studied for a gas sensing application. Tin dioxide thin films with different number of layers and annealing temperature were prepared on indium tin oxide substrates by sol-gel dip-coating technique. SEM micrographs show that the approximately grain size of the SnO₂ thin films increased with increasing number of layers and annealing temperature. X-ray diffraction analysis showed that the SnO₂ thin film was tetragonal at 400 °C. The calculating crystallite size from Scherrer's formula was about 40-60 nm. Dielectric property of desired SnO₂ thin films was investigated by LCR meter. It was found that the dielectric constant decrease when the frequency of applied signal and annealing temperature increases. Those properties of SnO₂ films were promising for electronics devices like gas sensor.

A5: Nanoscale and Surface / 588

Low-temperature Annealing Effects on Properties of Tin-doped Zinc Oxide Thin Films in Perovskite Solar Cells

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In this study, effects of low-temperature annealing on properties of tin-doped zinc oxide (TZO) thin were investigated. TZO film prepared by a sol-gel method is employed as an electron transport material in perovskite solar cells. After Sn doping, optical properties of the thin films changes. Different temperature annealing affects also surface morphology of the films. Since surface morphology changes, grains size of the upper perovskite layer also shows variation. Finally, the preliminary results indicate that the TZO films can be prepared at low-temperature process. The property of perovskite solar cells will be presented.

A5: Nanoscale and Surface / 440

Surface Modification of TiO₂ for Efficiency Enhancement in Perovskite Solar Cells

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Surface modification of titanium dioxide (TiO₂) substrates was performed to enhance efficiency of perovskite solar cells efficiency by inserting small organic molecules between TiO₂ electron transporting layer and CH₃NH₃PbI₃ perovskite layer. TiO₂ substrates were immersed into a solution of amino propionic acid (APA) or amino benzoic acid (ABA) in order to tune up and improve surface quality which leads to changes in PbI₂ and CH₃NH₃PbI₃ perovskite morphology and structure. Fourier transform infrared spectroscopy (FTIR), field-emission scanning electron microscopes (FE-SEM), X-ray diffraction (XRD) and open-circuit voltage-decay (OCVD) were performed to characterize material and device properties. It was found that introduced organic molecules change the PbI₂ precursor morphology which attributes to different trend of efficiency enhancement. Small cracks spreading through PbI₂ film coated on TiO₂/APA were observed. These cracks promote PbI₂ transformation to CH₃NH₃PbI₃ perovskite when reacts with CH₃NH₃I. The device with APA treatment show the improvement in power conversion efficiency from 6.23% for untreated TiO₂ condition to 7.78%. In addition, the OCVD analysis revealed that charge carrier lifetime of APA-treated device is significantly longer than that of the untreated device. These imply that this simple surface modification by small organic molecules could improve efficiency of perovskite solar cells.

A5: Nanoscale and Surface / 434

NiO_x as Hole Selective Contact to Improve Stability and Efficiency of Inverted Perovskite Solar Cells via Vacuum Flash Technique

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Abstract

The research in organic-inorganic halide perovskite solar cells (PSCs) is taking an upward trend. This is due to their excellent photovoltaic efficiency which is exceeding 22%, ease of processability and low cost. In order to meet the energy demand of the world using this technology, the stability and efficiency of PSCs need to be enhanced. This can be achieved by using hole-transporting materials (HTMs), which are fundamental building blocks of PSC architecture. It was reported that the utilization of a NiOx layer in PSCs increases an overall device performance due its high hole mobility, good stability, wide band gap, high transmittance and easy process ability. In this talk, I will present preliminarily results of the NiOx layers prepared by low temperature solution process for the development of stable and more efficient in inverted planar PSCs. In addition, the development of vacuum Flash technique (VFT) for preparing high crystallinity of a perovskite layer in ambient air will be presented and discussed.

A5: Nanoscale and Surface / 711

High quality nano-silica aerogels prepared by a facile method from bagasse ash under ambient pressure drying

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Nano-silica aerogels were synthesized from sodium silicate which is obtained from the reaction of bagasse ash and NaOH. Silanes and silazane was employed to control the formation and structure of silica aerogels in this study. To initiate the modification of silica aerogel properties, 1.0 M NH₄OH solution was utilized. The silica aerogel resulted from the reaction was dried under ambient pressure at temperature of 85 for 24 h. Results from preliminary experiment showed that silica aerogel with different surface area was obtained when it is prepared in different solvents and times. Hydrophobic properties of prepared gel is so high (water contact angle, about 120-140°) closed to the super-hydrophobic materials. Specific surface area and pore volume are quite high indicate the success of silica aerogels from biomass under drying at ambient pressure.

Keywords : Silica aerogels, Ambient pressure drying, Bagasse ash, Hydrophobic, Absorbent

A5: Nanoscale and Surface / 718

Studies on structural, characterization and electric properties of Cu-doped BiFeO₃ thin films

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Cu-doped BiFeO₃ thin films were fabricated by spin coating method. The thin films were deposited on Pt/Si-N type substrate. X-rays diffraction were used to reveal purity and impurity of Cu-doped BiFeO₃ thin films crystalline structure on Cu-doping concentration as 0, 0.1, 0.2, 0.5 and 1.0, respectively. X-ray absorption spectroscopy (XAS) were used to investigate Fe and Cu elements oxidation state. Scanning electron microscopy (SEM) were used to show surface morphology of Cu-doped BiFeO₃ thin films and thin films thickness (SEM Cross Section). Agilent4294A Impedance Analyzer were used to reveal dielectric constant and conductivity of thin films.

A6: Condensed Matter and Accelerators / 812**The study on temperature dependent superfluid density of anisotropic superconductors****Author:** Grittichon Chanilkul¹**Co-author:** Pongkeaw Udomsamuthirun ¹¹ *Srinakharinwirot University***Corresponding Author:** gchanilkul@gmail.com

The most of superconductors are highly anisotropic superconductors, then the measurement on superfluid density properties of superconductors are complicated that they are dependent on direction of measurement. In this study, the superfluid density of anisotropic superconductors was studied by semiclassical approach. We interested in the spin-singlet superconductors state with anisotropic spherical Fermi surface. The anisotropic gap function with ellipse spherical shape in weak-coupling limit was used. After some calculation, we can derive the temperature dependent formula of superfluid density near zero-temperature for ab- and c- spatial components. The numerical calculation fit to the experimental data of CaAlSi superconductors was shown and we found that our model can fit well. Then CaAlSi superconductor shows the anisotropic in the superfluid density.

A6: Condensed Matter and Accelerators / 702**The Stability Diagram of Single-Electron Transistors****Authors:** Titipong Phoophathong^{None} ; Supachai Ritjareonwattu^{None}**Corresponding Author:** titipongboom28@gmail.com

A new novel approach to model a single-electron transistor for the stability analysis was shown analytically. The electrostatic energy of the SET was investigated to obtain the condition of the state transition. With its simplicity, the tunneling conditions were analytically solved, and hence the stability diagram was plotted to show the stable regions and the state-transition boundary. The result strongly agreed to the stability diagrams previously reported with the different approach.

A6: Condensed Matter and Accelerators / 695**Study on Thermionic RF Electron Gun Properties after the Resonant Frequency Retuning****Authors:** NATTHAWUT CHAISUEB¹ ; Sakhorn Rimjaem¹**Co-authors:** Jatuporn Saisut ¹ ; Chirtlada Thongbai ¹ ; Noppadol Kangrang ¹¹ *Chiang Mai University***Corresponding Author:** natthawut_chai@elearning.cmu.ac.th

Relativistic femtosecond electron bunches can be produced from the electron linear accelerator (linac) system at the Plasma and Beam Physics (PBP) Research Facility, Chiang Mai University (CMU). A thermionic radio-frequency (RF) electron gun is used as an electron source for this accelerator system. The RF gun has a 1.6-cell S-band standing-wave structure, which has two main resonant cavities called half-cell and full-cell. The 2856 MHz RF wave is transmitted from the klystron to the full-cell through a rectangular waveguide input-port and is coupled to the half-cell via a side-coupling cavity. So far, two RF guns have been used at the PBP-CMU Electron Linac Laboratory. The first gun was

designed and constructed mostly in-house. The commissioning and operation of the gun were done with reliable performance. The second one was constructed at the National Synchrotron Radiation Research Center (NSRRC), Taiwan, R.O.C. The gun was transported from NSRRC to our laboratory and was tested after the cavity re-tuning process. The low-level and high-level RF measurements were conducted. This RF gun has a resonant frequency of 2855.68 MHz at 26.2°C with a quality factor of 12264. The high-power RF measurements showed that an optimal operating temperature of the gun was 34°C with an RF coupling coefficient of 4.57. The electromagnetic field distribution inside the gun was simulated by using the 3D-model created with the program CST Microwave Studio 2012[®]. Study of electron beam dynamics in the gun using program PARMELA was done to estimate the beam properties at the gun exit. Moreover, measurements of electron beam properties were performed to investigate the performance of this RF gun. The results showed that at optimal conditions the gun could produce the beam of about 2 μ s (FWHM) pulse width with a maximum kinetic energy of around 2.8 MeV and a macropulse charge of 850.1 ± 34.7 nC. Results from both beam dynamic simulations and measurements are presented and discussed in this paper.

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First principles study of local and electronic structures of yttrium-doped $\text{Ba}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$

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Here we report the first principles study of yttrium-doped $\text{Ba}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ (Y-doped BZT) for $x = 0.125, 0.250, \text{ and } 0.375$ supercells as a promising rare earth doped lead-free ferroelectric material. The local and electronic structures of Y-doped BZT and pure BZT relaxed supercells are systematically investigated in term of atomic pair distribution functions (PDFs), A and B site cation off-centering, and electronic density of states (DOS) respectively. The PDF spectrums show the increasing of structural disorder as a function of Zr concentration, while the short-range disorder is strongly influenced by the size of cation and their corresponding vacancies. Moreover, the drastic diffusion in PDF spectrums of Y-doped BZT reflects the compositional fluctuation on the local environment of the supercells. For cation off-centering, Ti^{4+} play a major role as the active ferroelectric distortion in BZT. However, the substitution of yttrium ions into BZT matrix enhanced the lattice distortion as observed from the increasing of off-centering magnitude for both A and B site cations. The calculated total and projected DOSs on d states of cations and O-2p states confirm the strong hybridization between Ti 3d and O 2p states, thus implying the covalent bonding in Ti-O₆ octahedral. On the other hand, the little effects of yttrium ions on the electronic structures, especially the highest and lowest valence and conduction bands, were observed.

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Fe oxidation state in heat-treated basaltic blue sapphire samples and its implications to the 3309 cm^{-1} -series peaks in infrared absorption spectra

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Ti atoms bond with Fe atoms and exchange their electron particles in the adjacent octahedral sites. This process produces the blue color on the blue sapphire. The Ti content is an important key to the alteration of the 3309 cm^{-1} , 3232 cm^{-1} , and 3185 cm^{-1} (3309 cm^{-1} -series) peaks in infrared absorption (FTIR) spectra of blue sapphire samples. To study the effect of Fe and Ti oxidation state and the behavior of the Ti-related peaks in FTIR spectra during the heating process, the blue sapphire samples from Phrae and Kanchanaburi, Thailand were collected regarding their basaltic origins. The heating experiment was performed. The samples were step-heated at $800\text{ }^{\circ}\text{C}$, $1000\text{ }^{\circ}\text{C}$, $1200\text{ }^{\circ}\text{C}$, $1400\text{ }^{\circ}\text{C}$, and $1650\text{ }^{\circ}\text{C}$ under an oxidizing atmosphere, with 1 hour soaking time at each temperature. The FTIR spectra and the X-ray absorption spectra (XAS) were measured before and after heating. Before heating, the FTIR spectra showed only the peak at 3309 cm^{-1} while the side peaks at 3232 cm^{-1} and 3185 cm^{-1} start to appear after heating at $800\text{ }^{\circ}\text{C}$. The 3309 cm^{-1} -series peaks were assigned as -Ti-OH stretching. The intensity of those peaks was slightly decreased after heat-treated. The XAS spectra revealed that the oxidation state of Fe is still Fe^{3+} while Ti is still Ti^{4+} in every heating temperature. The results pointed that the alteration of the 3309 cm^{-1} -series peaks does not depend on the Fe and/or Ti oxidation state.

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Single crystal growth of $\text{Zn}_x\text{Cu}_{1-x}\text{V}_2\text{O}_7$ ($x = 0.05, 0.15$) by the vertical gradient freezing technique

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Single crystals of $\text{Zn}_x\text{Cu}_{1-x}\text{V}_2\text{O}_7$ system with doping concentration of 0.05 and 0.15 were grown by the vertical gradient freezing technique. The crystal structures were confirmed by means of x-ray diffraction to be the beta phase of copper pyrovanadate, $\beta\text{-Cu}_2\text{V}_2\text{O}_7$, when the Zn concentration was as low as 0.05, on the contrary to the previous studies on polycrystal samples. The Rietveld refinement on x-ray diffraction patterns showed that lattice constant along crystallographic a-axis was slightly increased when the doping concentration was decreased from $x = 0.15$ to 0.05. A θ - 2θ scan confirmed that the natural cleaved facet is crystallographic a-axis with FWHM around (200) peak of $0.17(1)^\circ$, suggesting a high quality of the obtained single crystals.

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Oxidation State of Fe in Irradiated Sapphire by XAS Technique

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Corundum (ruby & sapphire) consists of Al_2O_3 and trace elements relating to the cause of color such as Cr, Fe, and Ti. Irradiation is one of gemstone enhancements for improving their color appearance. The aim is focused on the oxidation state of Fe ions that concern with the cause of yellow color in irradiated sapphire by XAS technique. In this study, natural sapphire samples from Sri Lanka were collected. The samples were irradiated with high energy electron beam at 40,000 kGy, 60,000 kGy,

and 80,000 kGy. XAS technique was emphasized on Fe *K*-edge XANES spectrum. The Fe-chemical standard includes FeO, Fe₂O₃, and Fe₃O₄ referred to Fe²⁺, Fe³⁺, and Fe^{2+,3+} respectively. According to the results, the absorption edge position of the Fe *K*-edge XANES spectra detected from the samples is similar to the position from Fe₂O₃. Moreover, the linear combination fitting of Fe ions in the samples compared with the Fe-chemical standard shows that the cause of yellow color on irradiated sapphire samples could be affected by Fe³⁺. Hence, it could be summarized that the increasing of yellow color in irradiated sapphire samples is due to the increasing of high energy electron doses and Fe³⁺ ratio.

A7: Astronomy I / 444

Evolution of V339 Del (Nova Del 2013) since 0.37 – 75 days after discovery

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We study the evolution of V339 Del (Nova Del 2013) during 0.37-75 days after discovery. Spectra from the Liverpool Telescope were collected and analysed to find the velocity of ejecta (v_{ej}), relative radiation with respect to continuum level (R^*_λ), and FWHM of the radiation. The evolution of light curve was explained by adopting an ideal nova light curve as criteria. We found that the evolution of V339 Del during $t = 0.37 - 75$ days can be explained in 7 phases: 1) Initial rise ($t = 0 - 0.6$ days); nova is suddenly brighter from $V \sim 11$ to ~ 6.4 . A maximum v_{ej} is ~ 2400 km/s. R^*_λ and FWHM first increases and then decreases where this joint ($t = 0.35$ days) turns out to be the first detection of X-ray. 2) Pre-maximum halt (0.6–1.2 days); There is a halt of brightness around $V \sim 5.1-5.9$, decreasing v_{ej} , increasing R^*_λ with decreasing FWHM. 3) Final rise ($t = 1.2-1.5$ days); Nova is brighter again to maximum. The variation of v_{ej} and radiation have similar trend to the halt phase. 4) Maximum ($t = 1.5-2.5$ days); Nova has maximum brightness of $V = 4.45 \pm 0.01$ ($t = 1.67$ days) decreasing v_{ej} and increasing R^*_λ until maximum value and the decreasing afterward, while FWHM decreases from the final rise. 5) Early decline ($t = 2.5 - 35$ days); Nova has a drop in brightness and v_{ej} . The last measurement of v_{ej} is $\sim 1100-1200$ km/s at $t = 35.5$ days. The radiation seems to have 2 distinct phases in this early decline including: First stage ($t = 2.2-12$ days) where R^*_λ and FWHM increase and nebular spectra begins around $t \sim 10$ days. In this stage the nova shell expands optical depth reduces, marking pseudo-photosphere shrink. Second stage ($t = 12-35$ days) where R^*_λ and FWHM decrease and SED shift to near-IR until not visible in optical ($t = 28$ days). Iron curtain ($t \sim +25$ days) was found near the time of first soft X-ray detection ($t = 35.6$ days). 6) Transition ($t = 35-60$ days); Brightness decreases where R^*_λ and FWHM gradually increase meaning it reveals deeper pseudo-photosphere. 7) Final decline ($t = 60-75$ days); Nova is fainter than 6 magnitude from maximum, R^*_λ and FWHM decrease, Nova is now in nebular phase permanently allowing us to see the surface of white dwarf for the first time.

A7: Astronomy I / 630

Optical monitoring of a transitional millisecond pulsar PSR J1023+0038

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PSR J10203+0038 is a transitional millisecond pulsar (tMSP) in an eclipsing binary system, which has been observed to switch between the radio loud millisecond pulsar (MSP) and low-mass-X-ray binary (LMXB) states. This behavior offers a great opportunity to study the origin of MSPs and confirming the ‘recycling’ scenario, a theoretical model of MSP’s origin. We develop an automated pipeline to monitor the system using Python programming language and Source-Extractor software for detecting the objects and measuring its magnitude. We obtain a series of observations with the 0.6m PROMPT-8 telescope at Cerro Tololo in Chile. The magnitude threshold for alert has been set 16.884 mag in R filter. When the magnitude of the system increases over the limit, 16.884 mag in filter R, the pipeline will alert us about the next possible switching of this system. The pipeline has been running on server at National Astronomical Research of Thailand (NARIT) since January 2018. We have found that, during January and February 2018, the system still remains in LMXB state.

A7: Astronomy I / 735

Point Source Classification on Astronomical Photometric Images Using Artificial Neural Network

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Gravitational Optical Transient Observer (GOTO) is a set of telescopes primarily for optical follow-up observation of gravitational wave from projects such as LIGO and VIRGO. It can cover at least 18 square degree of sky, and at most 36 square degree per pointing. The secondary objective of GOTO is to perform an all-sky survey. Each night, it could cover as much as 20,000 square degree of sky. Such large area of coverage produces as large number of objects. It was estimated to be able to collect 20 million sources per night. Processing such quantity of data manually is extremely difficult. One of the most challenging task is to perform object classification. A solution to this problem is to have machine perform classification, which is possible via machine learning algorithm. In this work, we use supervise machine learning performed on simulated data to create a point source classifier. We will focus on application and performance of artificial neural network in performing classification of point sources.

A7: Astronomy I / 704

Tracking cosmic-ray spectral variations during 2007-2018 using neutron monitor time-delay measurements

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Neutron monitors usually measure the flux of cosmic rays above a geomagnetic cutoff rigidity (momentum per charge). Recently, we have developed a new capability to also study the momentum (or energy) distribution of cosmic rays. Here we use time-delay histograms collected at the Princess Sirindhorn Neutron Monitor (PSNM), Thailand, which has the world's highest vertical cutoff rigidity for a fixed station (16.8 GV), and the South Pole neutron monitor with a low geomagnetic cutoff rigidity (near 0 GV). We present measurements of the leader fraction L of neutron monitor counts that did not follow other counts in the same counter tube from the same cosmic ray shower. Variations in the cosmic-ray spectrum can be precisely indicated by changes in L . PSNM started to collect time-delay histograms in Dec 2007 and the South Pole station started in Nov 2013. The electronics have been upgraded during our measurement period, and we have corrected for such changes to develop a long-term leader fraction dataset. In addition, environmental effects from the atmosphere including pressure and water vapor have been corrected. Our procedure extends precise tracking of solar modulation of the galactic cosmic ray flux to higher energies, above 17 GeV. We find that L varied with the sunspot cycle, and a hysteresis between L and the count rate implies a change in the shape of the cosmic ray spectrum due to solar modulation from before to after the solar magnetic polarity reversals of 2012-2014. Up until early 2014, solar modulation extended to energies well above the Doi Inthanon cutoff, but afterwards it extended only shortly above the cutoff. Measurements of L from the South Pole are particularly precise and will allow detailed studies of spectral variation of cosmic rays during Forbush decreases due to solar storms and over 27-day variations due to the Sun's rotation. Partially supported by Grant RTA5980003 from the Thailand Research Fund.

A7: Astronomy I / 663

A Study of the Orbital Period of WASP-43b

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WASP-43b is a hot Jupiter exoplanet with an ultrashort orbital period, 0.81347 days. From previous studies, there is a possibility that the orbital period of WASP-43b is decreasing. However, from the recent studies, the results show that there is no change in the orbital period of the system. Therefore, in this work, the orbital period change of WASP-43b is investigated. Nine transit light curves obtained from three telescopes, 0.7m ROP-NM at Regional Observatory for the public Nakhon Ratchasima, 0.5m TRT-TNO at Thai National Observatory and, 0.7m TRT-GAO at Gao Mei Gu Observatory in 2017-2018 are presented. We combine the mid transit time from our data with published mid transit time of WASP-43b. The result shows that WASP-43b has an orbital period change with the rate $dP/dt = +8.576$ milliseconds per years. Therefore, there is no evidence from tidal effect in the system.

A7: Astronomy I / 669

The search for X-ray emission from electron/positron pair halo using XMM-Newton observatory

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An electron/positron pair halo is formed by electromagnetic cascades that initiate when the high energy gamma-rays from extragalactic sources – i.e. Blazar AGN – interact with the cosmic infrared background (CIB) so that are absorbed via the electron/positron pair production process. The high energy electron/positron pairs produced could up-scatter the cosmic microwave background (CMB) so that become gamma rays that could interact with CIB again. Thus, the process could happen continuously until the produced gamma-rays have insufficient energy to interact with the CIB. Indeed, given the presence of intergalactic magnetic field, the produced electron/positron pairs could gyrate before scattered with the CMB photons so that emit X-ray photons via synchrotron radiation process. In this work, we aim to determine whether the predicted X-ray photons emitted from the halo can be detected by the current generation X-ray observatory: XMM-Newton. The Spectral Energy Distributions (SEDs) and the angular distributions of the synchrotron radiation of the pair halo predicted to be obtained from the AGN H1426+428 are simulated by the Monte Carlo simulations method; these are used as a source model for simulating observed spectra. Then, the spectra of the halo virtually observed by XMM-Newton are generated using the instrument Response Matrix Files (RMFs) and Ancillary Response Files (ARFs) obtained from the official webpage of the telescope. Based on the simulated spectra, we will discuss whether the X-ray photons emitted from the pair halo could be detected by XMM-Newton.

A7: Astronomy I / 554

Effects of Moon Transit on the Light Curve of Transiting Exoplanets

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To date, two exomoon candidates have been proposed but confirming their existence remains a challenging task as tools to fit light curves of exoplanets with moons are not yet available. Transit Timing Variation (TTV) and Transit Duration Variation (TDV) signals of transiting exoplanets due to the presence of moon, which have a phase difference of 90 degrees, provide a unique feature that can be used to confirm exomoon detection. In this work, we study how light curves generated from the moon-planet-star transit model differ from such light curves that are re-fitted using the Transit Analysis Package (TAP), where the simple planet-star model is adopted. The results give a qualitative explanation of how dynamical processes give rise to certain features present in TTV, TDV and transit depth signals. The identified features in these signals are described. Interesting features include the systematic rise and fall of variation signals at primary and secondary moon transit within the planet disc, and excess TDV signals for all moon phases. This study provides a concrete framework for confirming moon detections.

A7: Astronomy I / 662

Palatini NMDC gravity : cosmological scalar field phase portraits in exponential potential

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We consider cosmological scalar field evolving under exponential potential of the Non-minimal Derivative Coupling (NMDC) gravity model in Palatini formalism. Slow-roll regime is assumed. GR and metric formalism NMDC cases are compared in this study. Phase portraits show that Palatini NMDC effect restricts acceleration phase into smaller region in the phase space. NMDC effect of the Palatini case enhances rate of expansion to larger than that of the GR and of the metric formalism cases.

A7: Astronomy I / 586

Timing noise of 133 pulsars in the southern hemisphere

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Pulsars are small, dense stars which rotate up to 1500 times per second and emit radio waves in a directed beam along their magnetic axis. Pulsars are remarkably stable rotators, and by measuring the arrival times of the radio beam the pulsar can be used as a clock in space. Applications of pulsar timing have led to the first exoplanet system, stringent tests of theories of gravity and have the potential to detect gravitational waves. The pulsar clocks are not perfect though, and understanding the imperfections (timing noise) is important for the future of the field. We therefore study timing results from 133 pulsars observed with the Parkes radio telescope in Australia over a period of 4 years. The aim of the project is to understand the correlation between timing noise and other pulsar parameters such as age and spin-down energy. First results are presented here.

A7: Astronomy I / 441

Status of oEA stars studies in Thailand.

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We will give a review of the THASSOS (THAi Sky Survey of oEA stars) project which is focused on the photometric and spectroscopic search for and studies of mass-accreting pulsating components of Algol-type systems (oEA stars). We will report about recent discoveries of new oEA stars obtained with NARIT's facilities and discuss the difference in the oscillation spectra of mass-accreting components.

A7: Astronomy I / 498

Simulation of neutrino signal from dark matter annihilation for JUNO experiment

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Dark matter plays major role in the large-scale structure formation of the universe. The leading candidate for DM particle is generally called Weakly Interacting Massive Particles (WIMPs) for its properties inferred from astronomical observations. Such DM particle would only interact via weak interaction and could decay or self-annihilate into other standard model particles such as $\tau\bar{\tau}, u\bar{u}, e^+e^-$. In this work, we stimulate the final-state neutrino particles resulting from DM annihilations inside the SUN's core. The neutrino propagations and oscillations to Earth and expected signals at the Jiangmen Underground Neutrino Observatory (JUNO) are then calculated. We will present the preliminary results of our study, including comparisons with various other neutrino sources to be detected at JUNO.

A7: Astronomy I / 550

Ultraviolet Study of the unusually high spectral index regions in the Planck HFI maps

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In this work, we present a study of regions near the Galactic plane with extreme spectral index, $\beta \approx 8-9$, which was calculated using PLANCK temperature maps for frequency bands at 143, 217 and 353 GHz. Usually, the radiation from Galactic plane regions in these frequency ranges is dominated by thermal dust emission with typical spectral index $\beta \approx 1-2$. It is rather challenging to study such a large region at this sub-mm frequencies with a high-frequency radio survey. Therefore, Ultraviolet (FUV and NUV) observational data are used as the UV is a signpost of Star formation regions. The radiation of UV in the extreme spectral index regions higher than UV radiation in normal spectral index regions.

A7: Astronomy I / 447

HI Observations of MaNGA Galaxies with the Green Bank Telescope.

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We present the 21 cm neutral hydrogen (HI) observations of 439 nearby galaxies from the Green Bank Telescope, USA. Our targets are drawn from the Mapping Nearby Galaxies at Apache Point

Observatory (MaNGA) program, whose sample is uniformly selected from the SDSS Data Release 13 with the stellar mass greater than $10^9 M_{sun}$ and no pre-selection on galaxy type. The average redshift of the sample is $z \simeq 0.03$. The primary goal of the project is to study how the HI detectability and mass depend on host galaxy properties, specifically, the stellar mass and the presence of active galactic nuclei (AGN). In this presentation, we report the HI detection fraction and gas fraction as a function of galaxy's locus on the color-magnitude diagram (CMD), as well as the HI detection fraction as a function of the incidence of AGN, based on the Baldwin-Phillips-Terlevich (BPT) diagnostics using the SDSS optical spectroscopy. We found that both the HI detection fraction and the neutral gas fraction in the 'blue cloud' locus on the CMD is significantly higher than in the 'red sequence'. Our observations indicated that the incidence of AGN does not show significant preference in the HI gas properties.

A7: Astronomy I / 439

Do Changing Snow Levels Effect the Count Rate of the South Pole Neutron Monitors?

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Neutron monitors are instruments that can be used to study low energy cosmic rays. In addition to providing information about the fundamental properties of cosmic rays, such as how they are produced and their composition, they may be helpful for forecasting space weather. This could provide an early warning against increased radiation levels for satellites or astronauts in space from solar storms for example. It is important to understand how environmental factors, especially those that can change, affect the neutron monitors. This project studied the impact of varying snow levels below a platform that held three single neutron monitor 64 sections in separate environmental enclosures at the South Pole. The platform is currently three meters above the ground. Snow can drift beneath the rack, potentially affecting the count rate recorded by the neutron monitors. If that is the case, then longer term studies would have to correct for these changes. The goal of this project was to produce a simulation of the South Pole configuration, and see if changing the snow level has a measurable impact on the count rate. The environment, neutron monitors and particle beams were modeled using FLUKA simulation software. Results of the counts per incident neutron beam luminosity as a function of energy and snow height below the neutron monitors will be reported.

A8: Instrument I / 794

Optical frequency measurement comparison using fiber laser combs between NIMT and CMS

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A NIMT optical frequency comb was compared with an Er-fiber laser comb with repetition frequency of 250 MHz made by the Center for Measurement Standards (CMS), Taiwan by simultaneously measuring the frequency of a 633 nm He-Ne laser. The difference of average frequency measurement is 283 Hz and corresponds to a relative difference of 6.0×10^{-13} .

A8: Instrument I / 714

Construction of Blood Pressure Monitor by Using Photoplethysmography Calibrating with Upper-arm Blood Pressure Monitor

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A photoplethysmography (PPG) is one of an alternative technique for monitoring personal health with the advantages of non-invasive, inexpensive, and easy to use. In this work, PPG is used to estimate blood pressure with the aim to construct a prototype of blood pressure monitor by photoplethysmography and calibrate with upper-arm blood pressure monitor. The NIR LED light source, and detector is used to obtain PPG signal. The PPG signals from blood pressure prototype are recorded with band pass filter and used for calibration with upper-arm blood pressure monitor in 10 volunteers. It is found that the maximum and minimum value of PPG signals show linear dependence of systolic and diastolic blood pressure from the commercial blood pressure monitor with $R^2=0.72$. The obtained linear relation is applied to calibrate the measured PPG signals and to test with 12 volunteers. From the test, the precision of systolic and diastolic blood pressure from the prototype are 8 mmHg and 6 mmHg respectively and the accuracy is equal to ± 10 mmHg compared with that of commercial blood pressure monitor of ± 3 mmHg. Thus, the prototype of blood pressure shows less accuracy than that of commercial blood pressure monitor and may not medically use for health monitoring. However, the prototype maybe practically use as a screening tool for monitoring blood pressure due to easy to use and fast measurement.

A8: Instrument I / 712

Simulation Analysis of Surface Deformation Due to Newly Design Optical Mounting Using Numerical Model

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Flatness is one of the key components that determine quality of the mating parts. It also can be used to interpret performance of the production process or the machine tools. Orientation and fixture used in holding the object also affect flatness of the surface. This paper investigated effect of the mounting configuration to flatness of the flat surface. Flatness of the optical flat diameter 300 mm was experimentally measured using phase shifting Fizeau interferometer which is equipped with the He-Ne laser generating a single wavelength illumination and phase shifter. Phases of the interference pattern were determined from the 9-steps phase shifting algorithm developed by D. W. Phillion. The optical flat was hold horizontally using optical mounting. This optical mounting was

designed that supporting position and clamping force can be varied. The experimental result and the simulation result from the finite element method (FEM) were compared. The clamping force was found to be directly related to the deformation scale of the flat surface. Both experimental result and the simulated result were found to be well correlated which confirmed trueness of the simulated result. The finite element was conducted further in order to confirm the newly designed optical mounting and to investigate effect of the holding position. The designed optical mounting equipped with 13 supporting positions which diameter of the workpiece can be adjusted from 150 mm up to 330 mm. Optical flat made from quartz, diameter 300 mm and thickness 50 mm, weights approximately 10 kg. The analysis result strongly indicated the improvement of the deformation of the surface by factor of 2.

A8: Instrument I / 665

Preliminary results of absolute thickness measurement using optical comb interferometry

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Non-contact absolute thickness measurement is necessary especially to delicate specimen or optics where deformation and scratch must be avoided. The absolute thickness of a specimen can be measured using various optical methods but the refractive index of the specimen shall be pre-determined with high accuracy. In this paper, we applied an optical-domain interferometer using an optical frequency comb as a light source and a spectrum analyzer as a detector. Preliminary results on thickness measurement of a single glass plate and a stacked glass plate are reported here. The key advantage of this technique is that the knowledge of refractive index is not required. This method shows promising possibility for measuring absolute thickness of a multi-layer specimen such as wafer.

A8: Instrument I / 475

Density Determination of Irregular Shaped and Small Glass Fragments by Stoke's Law: An Alternative Technique for the Forensic Analysis of Glass

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Glass fragments are one of evidence that can be found in many crime scenes and used to include or exclude suspects or victims from the criminal event. For many years, a typical method known as a sink-float method has been used in many investigation laboratories to prove the correspondence between the questioned glass fragments and the reference ones by matching their density values. However, the major drawback of the method is to use toxic solutions such as Bromoform and Bromobenzene in the investigation process. To overcome such as a drawback, a technique based on

the Stoke's law is proposed in this study. By using two known properties of fluids in the analysis, size, and shape of the questioned glass fragments are unnecessary. Five types of the sample glass fragments are examined: laboratory glassware, glass bottles, car glass, architectural glass, and kitchenware glass. To verify the technique, the density of all glass fragments obtained from the proposed technique are crosschecked against the ones measured by the buoyancy method of ASTM Standard test method (C693-93). The results reveal that the density of glass fragments was close to the reference values. This shows the potential of the proposed method in determining the glass density in the forensic analysis.

A8: Instrument I / 445

Form error measurement of spherical object

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The diameter measurement of sphere is very important in dimensional metrology. However, most of diameter measurement carried out by using 2 points method measuring distance from opposite site of the sphere. For work which require high accuracy or the mating part where the contact area cover the large area of the object, form error of the part is need to be determined. One of the mostly use method is roundness measurement where variation of radius in one plane was investigated. Here, we present the measurement technique for form error or sphericity measurement. With this new capability, not only the quality of spherical product can be improved but the accuracy of the spherical part can also be well evaluated.

A8: Instrument I / 818

Smartphone Microscope: Application of the State-of-the-Art Mobile Technology in Science Education

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A8: Instrument I / 575

The development of small water flow facility at National Institute of Metrology, Thailand

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The flow and volume of liquid laboratory of the National Institute of Metrology, Thailand (NIMT) has developed the latest facility which covers the liquid flow measurement range from (10 – 1,000) mL/h. This facility has been developed according to the need of high accuracy equipment in several of industries such as pharmaceutical products, fuel cell, semiconductor and medical devices. For accuracy purposes, the gravimetric method is decisively implemented as the main principle of the calibration rig. It comprises of three main parts; water supply system, weighing system and data

acquisition system. Practically, the capability of the facility is confirmed via a transfer standard. With high accuracy and repeatability, the Coriolis mass flow controllers were selected as the transfer standard. The facility can provide the best capability of calibration, CMC, at 0.30% of reading. Moreover, the evidence of unofficial comparison between NIMT and Federal Institute of Metrology, METAS, Switzerland, has confirmed this capability via the degree of equivalence, E_n ratio. The E_n ratios represent that the comparison of the flow rates from (10 – 1,000) mL/h between NIMT and METAS are agreed.

A8: Instrument I / 571

The case study of water flow measurement comparison in the range of (12-120) L/min

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Nowadays, the water flow measurement involves in our daily life such as water meters for tap water, hydrocarbon flow meters at petrol stations, etc. Those flow meters have to be calibrated by higher accuracy equipments with the accredited calibration laboratory. Therefore the accreditation laboratory has to complete the measurement comparison with reliable laboratory or the National Institute of Metrology (Thailand), NIMT which confirms the traceability chain and the measurement capability. However, the liquid primary standard at NIMT applies volumetric principle to measure flow rate which differs from other laboratories using gravimetric method. Thus, the case study of water flow measurement comparison has been done to verify the possibility of compatibility of those two methods. With high accuracy and good repeatability, the Coriolis mass flow meter was used as the transfer standard in the range of (12 – 120) litre per minute and (12 – 120) kilogram per minute. The comparison result of both measurement principles are considered by using the degree of equivalence, E_n ratio. The result shows that E_n ratio is less than 1 which means that both principles are agreed.

A8: Instrument I / 545

An application of spectrophotometer for ADMI color measurement

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The ADMI color scale is developed to measure the color of wastewater as an indicator of water quality. ADMI color is a metric quantity based on the Adams Nickerson color difference between the APHA/Pt-Co liquid standards and water. The Adams Nickelson color formula is obtained by transforming CIE tristimulus color indices into a uniform metric color scale that is independent of hue. If two colors of different hues are different to the same degree from the reference colorless water, then the difference will be the same. For a general purpose spectrophotometer with a measuring range of 360 nm to 830 nm and the wavelength resolution of 1 nm, we developed an ADMI color application based on APHA 2120F weighted-ordinate spectrophotometer method for measuring the color of wastewater in the range of 0 ADMI to 500 ADMI.