network enterprise europe

EIROforum
Science-Business WAMAS
Workshop on Advanced Materials And Surfaces
19-20 November 2013 CERN, Meyrin, Switzerland

Brokerage Event
Catalogue of Profiles

CERN · EIROforum · EuCARD² · CCI RHÔNE-ALPES · enterprise europe network · Business Support on Your Doorstep · European Commission

Introduction

The Chamber of Commerce and Industry of Rhône-Alpes region (CCIR RA), member of Enterprise Europe Network, organizes with CERN, member of EIROforum, a unique **Brokerage Event** in the framework of the EIROforum Science-Business Workshop on Advanced Materials and Surfaces.

The scope of this Brokerage Event is to promote advanced technologies in the field of materials and surfaces and foster their industrial applications. Sharing research centers' expertise will facilitate product development and will allow SMEs to gain a competitive advantage in its field. Face-to-face meetings will be organized between research centers and industry representatives.

Enterprise Europe Network will provide specific support to participants in order to facilitate their exchange ant take advantage of opportunities of developments.

CALENDAR

19 November

- **Conferences / 9h00-18h30**

Advanced materials and surfaces developed to stand extreme environmental conditions, characterization techniques based on advanced technologies

- **Exhibition stand / 9h00 – 18h30**

Selected exhibitors present their best practices and latest technologies in the CERN Globe of Science and Innovation

- **Gala Dinner / 19h00 – 22h00**

20 November

- **Conferences / 8h30 – 13h00**

Advanced materials and surfaces developed to stand extreme environmental conditions, characterization techniques based on advanced technologies

- **ATLAS and NEG laboratory visit / 13h00 – 14h30**

- **Matchmaking Event / 14h30 – 17h30**

Face to face meetings between research centers and industry representatives

- **Exhibition stand / 8h00 – 17h30**

Selected exhibitors present their best practices and latest technologies in the CERN Globe of Science and Innovation

See detailed program on the dedicated website:

cern.ch/wamas

WAMAS Organizing committees

Local organizing committee

Matteo Castoldi **– CERN**
Enrico Chesta (Chairman) **– CERN**
Marina Giampietro **– CERN**
Marie-Christine Larchern **– CERN**
Tim Tsarfati - **CERN**
Silke Bachmann **- CERN**
Salvatrice Bufalino - **CCI Rhône-Alpes / EEN**
Etienne Fayolle - **CCI Rhône-Alpes / EEN**
Leo Tripiana - **CCI Rhône-Alpes / EEN**

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Richard Campbell - **ILL**
Mark Casali – **ESO**
Gianfranco Federici – **EFDA / F4E**
Roberto Felici – **ESRF**
Thomas Hansen – **ILL**
Frédéric Le Pimpec – **European XFEL**
Christopher Semprimoschnig - **ESA**
Stefano Sgobba (Chairman) - **CERN**
Mauro Taborelli – **CERN**

EIROforum organizing committee

Paola Batistoni – **EFDA-JET**
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Eileen Clucas - **ILL**
Aude De Clercq – **ESA**
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Gabor Lamm - **EMBLEM**
Vetle Nilsen – **CERN**
Edward Mitchell - **ESRF**
Enikoe Patkos - **ESO**
Frank Salzgeber - **ESA**

Main organizers

CCI de région Rhône-Alpes

Regional Chamber of Commerce and Industry (CCIR RA) is a public organization dedicated to companies representing the network of Chambers of Commerce and Industry in Rhône-Alpes. CCIR RA is member of Enterprise Europe Network, operating in 54 European countries through 6000 experts, supporting SMEs in transnational cooperation.

CCIR RA Technology transfer project managers provide services to regional companies and research centers in innovation support, valorisation of their technologies abroad, detection of innovations, international partner search, and access to European projects.

CCI RA organizes Brokerage Event and Missions in order to foster technology transfer and business cooperation.

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Enterprise Europe Network

Enterprise Europe Network is the largest network in Europe providing dedicated services to SMEs and Research Centers through 600 contact points, 6000 experts based in 54 countries (UE and associated countries).
Launched in 2008 by the European Commission, the Enterprise Europe Network combines and builds on the former Innovation Relay Centers and Euro Info Centers (established in 1995 and 1987 respectively). The new integrated Network offers a “one-stop shop” to meet all the information needs of SMEs and companies in Europe.

- Our mission is to provide to companies and laboratories European business and innovation support.

What can **Enterprise Europe Network** do for me?

- **Helping SMEs and laboratories to find potentials partners for innovation or valorization of their technologies.**

  Promoting my technology and know-how at a European Level
  In order to have your skills better known in new countries or branches of activity, a consultant will define your technology profile and start a targeted partner search. Support will be provided until an agreement is reached.

  Helping to find a technology and/or know how requested
  According to your technology interests, an anonymous profile will be defined and thanks to the Network we will search for suitable technologies, or companies / research centers able to cooperate in order to solve the technological problem or to co-develop the new technology.
  Enterprise Europe Network has also a portfolio of around 4000 technological offers and requests per year.

  Participating to technology brokerage events and/or company missions
  Everywhere in Europe, brokerage events, company missions and meetings are organized by our Network, often in parallel to thematical events such as international exhibitions.

- **Receiving information on European Research & Development programs**

The 7th R&D Framework Program (FP7) and now the new program H2020, are very interesting and powerful tools for European companies: it is a means to structure and finance collaborative R&D projects. Enterprise Europe Network facilitates the understanding of European fundings programs and initializes first level support for interested companies.

- **Giving information on all European issues**

- EU legislation and Member States' internal legislation
- Customs/tax
- Public procurement
- Standards / certification

- **Informing and giving advice to facilitate the international development of SMEs**

- Information and advice on European markets: opportunities, constraints, etc
- Support to partner search: we insert your profile in a European database and select partnership offers.

- **Warning the European Commission of dysfunctions and obstacles met by entrepreneurs on the European markets**

Enterprise Europe Network proposes your participation in EC consultations or enables you to inform the Commission about obstacles you meet in the framework of your European activities.

If you need further information, don't hesitate to visit our website and find your local contact:

http://www.enterprise-europe-network.ec.europa.eu

European Organisation for Nuclear Research (CERN)

At CERN, the European Organization for Nuclear Research, physicists and engineers are probing the fundamental structure of the universe. They use the world's largest and most complex scientific instruments to study the basic constituents of matter - the fundamental particles. The particles are made to collide together at close to the speed of light. The process gives the physicists clues about how the particles interact, and provides insights into the fundamental laws of nature.

The instruments used at CERN are purpose-built particle accelerators and detectors. Accelerators boost beams of particles to high energies before the beams are made to collide with each other or with stationary targets. Detectors observe and record the results of these collisions.

Founded in 1954, the CERN laboratory sits astride the Franco-Swiss border near Geneva. It was one of Europe's first joint ventures and now has 20 member states.

The Knowledge Transfer Group helps disseminating the innovation generated at CERN and maximizing its impact.

For more information:

cern.ch/knowledgetransfer

EIROforum

EIROforum is a partnership between eight of Europe's largest inter-governmental scientific research organizations that are responsible for infrastructures and laboratories: CERN, EFDA-JET, EMBL, ESA, ESO, ESRF, European XFEL and ILL.

It is the mission of EIROforum to combine the resources, facilities and expertise of its member organizations to support European science in reaching its full potential.

The EIROforum Thematic Working Group on "Innovation Management and Knowledge / Technology Transfer" (TWG-IMKTT) acts as a discussion forum and as a coordination platform to enhance the cooperation of the EIROforum organisations in the areas of Innovation and Knowledge/Technology Transfer, for the successful translation of the European academic research into tangible benefits for the European Society.

For more information:

www.eiroforum.org

EuCARD-2

(Enhanced European Coordination for Accelerator Research & Development)

EuCARD-2 is an Integrating Activity Project for coordinated Research and Development on Particle Accelerators, co-funded by the European Commission under the FP7 Capacities Programme, which contributes to positioning European accelerator infrastructures at the forefront of global research.

For more information:

www.eucard2.web.cern.ch

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Brokerage Event WAMAS – November 20th – 14:30 / 17:30

Index of technology profiles

3D OXIDE **21**
Reference: TO_FR_020901

Complex 3D shaped oxide thin films

ALLIANCE CONCEPT **23**
Reference: TO_FR_010902

Physical Vapor Deposition(PVD) thin films system developer

AL.MEC SRL **25**
Reference: KHTR_IT_110403

Finite element model of soft tissue sandwich from artery to skin

ANONYMOUS **27**
Reference: TR_CH_120204

Looking for Technology Support in HV Ceramic Insulators, SEEY-reducing coatings, NEG coatings, or HV Stability

ANONYMOUS **29**
Reference: TKHR_CH_120205

Looking for innovative material/material production technologies/also tools-related

ARRAELA S.L **30**
Reference: TO_ES_010106

DEVELOPING NEW MATERIALS FOR RADIOLOGICAL PROTECTION

CARNOT MICA **33**
Reference: KH_FR_110107

Elaboration of materials with innovative properties

CETIM-CERMAT **35**
Reference: KH_FR_010108

Consulting and tests for material choices, Engineering of endurance tests, R&D and Projects

DMX **37**
Reference: TKHO_FR_020909

PVD and PECVD coatings for mechanical applications

CRYOGENIC ENGINEERING & MATERIALS EXPERTISE (CEME) **39**
Reference: KH_DE_121010

Materials characterization at cryogenic temperatures

CRYSTAL INNOV **41**
Reference: RTD_FR_110111

Technology center for innovation in crystal growth and preparation

CSEM **43**
Reference: KH_CH_110212

Advanced materials characterization using state-of-the-art microscopy and XRD techniques focusing on the relationship between micro-structural and mechanical properties

DANISH TECHNOLOGICAL INSTITUTE **46**
Reference: RTD_DK_110913

Materials testing and development laboratory seeking partners in research and industrial applications in materials science and coating development

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **48**
Reference: RTD_CH_010714

Innovative chemical etching of multilayered printed circuits

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **50**
Reference: RTD_CH_010415

Innovative Metal Matrix Composites (MMC) with high thermal and electric conductivity

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **52**
Reference: RTD_CH_111916

Magnetic process to reduce multipactoring in radiofrequency devices

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **55**
Reference: RTD_CH_010217

Nano-structured target for radioisotope production

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **57**
Reference: RTD_CH_010918

Non Evaporable Getter (NEG) & Palladium thin film coatings

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **59**
Reference: RTD_CH_111219

Titanium electropolishing process with low electrical consumption and high surface smoothness

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **61**
Reference: RTD_CH_110020

Consultancy in material selection, development and characterization

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **63**
Reference: RTD_CH_010221

Highly transparent Ultra High Vacuum chambers

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **65**
Reference: RTD_CH_010222

Looking for a novel technique to characterize materials for beam intercepting devices as well as to using traditional techniques to characterize at very high temperatures (2500-3000° C)

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **67**
Reference: RTD_CH_010423

Design of high transparency beam pipe supports for LHCb with materials having a strong resistance to radiation and high temperatures

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **70**
Reference: RTD_CH_010424

Looking for thin, leak-tight Al alloy shells and advanced techniques to join aluminum components 70

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **72**
Reference: RTD_CH_110125

High-Radiation to Materials (HiRadMat) Facility of CERN/SPS for material analysis

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **76**
Reference: RTD_CH_011226

Material and fabrication challenges of superconducting accelerating cavities

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **78**
Reference: RTD_CH_110827

Experimental study and constitutive modeling of discontinuous plastic flow in austenitic steels at very low temperature

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **80**
Reference: RTD_CH_110828

Development of novel aluminum-based stabilizer solutions for superconducting cables, applicable to future detector magnets

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **83**
Reference: RTD_CH_110229

High-precision microscopic techniques to analyze materials and scientific support

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN) **85**

Application of thin film coatings on complex geometries

EUROPEAN SPACE AGENCY (ESA) **86**
Reference: RTD_NL_120730

Method and apparatus for testing materials

EUROPEAN SPACE AGENCY (ESA) **89**
Reference: RTD_NL_020931

New Antistatic Paints providing Antistatic Protection and Radiotransparancy

EUROPEAN SPACE AGENCY (ESA) **91**
Reference: RTD_NL_020932

POLYMET – advanced materials

EUROPEAN SPACE AGENCY (ESA) **93**
Reference: RTD_NL_020933

Friction Reduction by DICRONITE® Dry Lubrication Technique

EUROPEAN SPACE AGENCY (ESA) **96**
Reference: RTD_NL_011534

Elastomers to Protect Devices from Pyrotechnical Shocks

EUROPEAN SPACE AGENCY (ESA) **98**
Reference: RTD_NL_010735

Super Plastic Forming (SPF) combined with Diffusion Bonding

EUROPEAN SPACE AGENCY (ESA) **100**
Reference: RTD_NL_010736

Hall Effect Plasma Sources for Etching and Coating

EUROPEAN SPACE AGENCY (ESA) **102**
Reference: RTD_NL_010137

Advanced Materials & Ceramic Matrix Composites

EUROPEAN SPACE AGENCY (ESA) **104**
Reference: RTD_NL_010438

Cesic : Carbon-Fibre Reinforced Silicon Carbide – Light-Weight Mirror Technology

EUROPEAN SPACE AGENCY (ESA) **106**
Reference: RTD_NL_000039

Ascertaining surface hygiene: fast and easy

EUROPEAN SPACE AGENCY (ESA) **108**
Reference: RTD_NL_020940

Silicon Carbide (SiC) deposition by PECVD technique

EUROPEAN SPACE AGENCY (ESA) **111**
Reference: RTD_NL_020741

SL-MMC – Self Lubricating Metal Matrix Composite for bearings and electrical slip-rings

EUROPEAN SPACE AGENCY (ESA) **113**
Reference: RTD_NL_010142

Radiation shielding using micro cavities filled with highly pressurized gas

EUROPEAN SPACE AGENCY (ESA) **116**
Reference: RTD_NL_010743

Nanotechnology and Resin Transfer Molding (RTM)

EUROPEAN SPACE AGENCY (ESA) **121**
Reference: RTD_NL_010044

SILICA-BASED AEROGEL

EUROPEAN SPACE AGENCY (ESA) **123**
Reference: RTD_NL_010045

High performing and cost effective insulation material

EUROPEAN SPACE AGENCY (ESA) **125**
Reference: RTD_NL_010946

Ultra Low Friction Films of MoS2

EUROPEAN SPACE AGENCY (ESA) **128**
Reference: RTD_NL_010747

Method and means for connecting thin metal layers

EUROPEAN SPACE AGENCY (ESA) **131**
Reference: RTD_NL_111648

Method and apparatus for combinatorial alloy discovery and development using high energy electron beams.

EUROPEAN SPACE AGENCY (ESA) **134**
Reference: RTD_NL_010749

Method and system for production and additive manufacturing of metals and alloys

EUROPEAN SYNCHROTRON RADIATION FACILITY (ESRF) **136**
Reference: RTD_FR_110850

Synchrotron X-ray facilities and scientific support for industrial materials characterization

EUROPEAN SYNCHROTRON RADIATION FACILITY (ESRF) **139**
Reference: RTD_FR_110751

IRT NanoElec – Large-Scale Instruments Characterisation Program

HEF IREIS **141**
Reference: TO_FR_020952

Thin film imbedded nanoparticles obtained in large size vacuum deposition systems

IDEA SRL **143**
Reference: TR_IT_010153

Tactical shelter material developer looking for industrial and scientific partners

INSTITUT LAUE-LANGEVIN **145**
Reference: RTD_FR_110854

Neutron reflectometry technique to determine the surface properties of complex liquid mixtures

INSTITUT LAUE-LANGEVIN **147**
Reference: RTD_FR_110455

Role of neutrons to determine the structure of complex material under deformation

INSTITUT LAUE-LANGEVIN **149**
Reference: RTD_FR_110756

Neutron Powder Diffraction

ISTITUTO NAZIONALE DI ASTROFISICA **151**
Reference: RTD_IT_010557

Photochromic materials for adaptable optical metrology

ISTITUTO NAZIONALE DI ASTROFISICA **153**
Reference: RTD_IT_011358

Holographic Optical Elements for astronomical instrumentation: materials improvements.

INSTITUT DES MICROTECHNOLOGIES APPLIQUÉES ARC, HAUTE ECOLE-ARC INGÉNIERIE **154**
Reference: RTD_CH_010159

MeV ions for materials surface characterization and large area micro and nanostructuring.

ISRAEL AEROSPACE INDUSTRIES (IAI) **158**
Reference: TO_IL_020460

Advanced Materials & Surface for Aerospace and Electronics Industry

LAM PLAN **160**
Reference: RTD_EF_021973

Polishing and lapping technology

LS INSTRUMENTS AG **162**
Reference: TKHO_CH_110261

Dynamic and Static Light Scattering Technologies Offer

NATIONAL INSTITUTE FOR LASER, PLASMA AND RADIATION PHYSICS **164**
Reference: RTD_RO_020962

Nanostructured thin film preparation using thermionic vacuum arc (TVA) technology

NATIONAL INSTITUTE FOR LASER, PLASMA AND RADIATION PHYSICS **167**
Reference: RTD_RO_020963

Combined Magnetron Sputtering and Ion Implantation technology

NATIONAL INSTITUTE FOR LASER, PLASMA AND RADIATION PHYSICS **171**
Reference: RTD_RO_110464

Advanced X-ray imaging for composite and superconducting materials and structures

NTET SPA **174**
Reference: TR_IT_010465

Carbon based technopolimers for special applications

POLITECNICO DI TORINO **176**
Reference: RTD_IT_110166

Glasses, Ceramics and Composites (GLANCE)

RAY TECHNIQUES LTD. **180**
Reference: TO_IL_020967

Nanodiamonds powder of high purity and wide range of its applications

RX SOLUTIONS SARL **183**
Reference: TKHO_FR_110868

X-Ray non destructive testing specialist (Digital Radioscopy and 3D CT Scan)

SAMES TECHNOLOGIES **185**
Reference: TO_FR_020969

New surface deposition method - electrostatic pulverization

SILSEF **188**
Reference: TO_FR_010770

Structured and functionnalised materials

VENETIX ADVANCED MATERIALS **191**
Reference: TO_FR_010171

INNOVATIVE MATERIALS AND SHEARING TOOLS

FRANCE 3D OXIDE

Company

Keywords

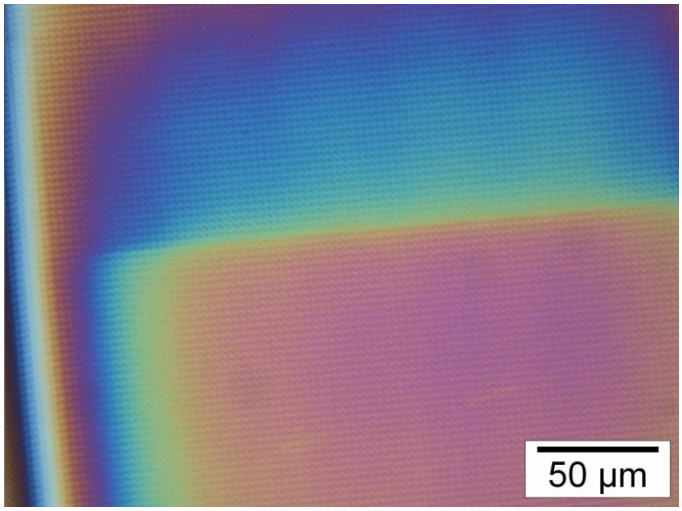
Coatings, Materials and Powders, Colors and varnish, Composite materials

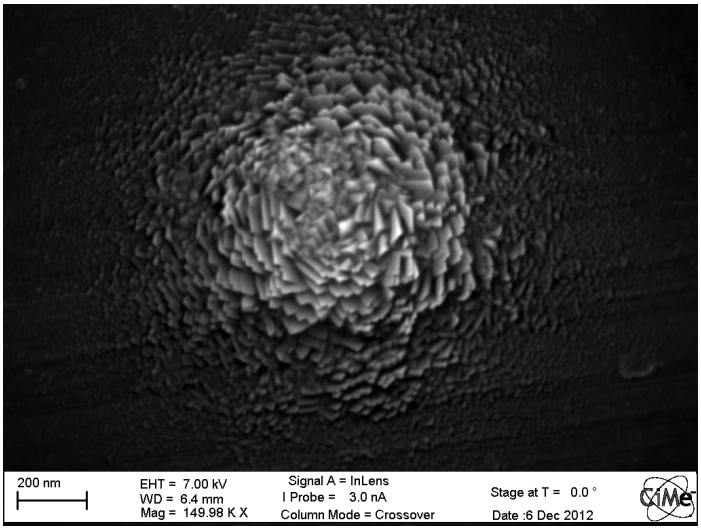
Technology offer Reference: **TO_FR_020901**

Complex 3D shaped oxide thin films

Technology description	3D-Oxides is a French company which develops disruptive multi-functional oxide thin films materials. With a unique combinatorial approach, 3D-Oxides can rapidly develop multi-element thin films and pattern them in a single step during the growth in an additive approach with complex 3D shapes both at morphological or chemical (functional) level.
Innovation features and advantages	3D-Oxides technology has several advantages in comparison to competitor technologies. The first one is the capacity to achieve combinatorial deposition to rapidly scan a wide range of different materials in a single step (variation of chemical composition, nano size and shape or interface effects). Furthermore we can pattern the thin films in a single step allowing much more complicated shapes and properties that cannot be achieved with standard technologies.
Current and Potential Domains of Application	Thanks to the investigated multi-functional materials, 3D-Oxides is involved in several fields like, photovoltaic, hydrogen generation, fuel cells, nano-bio coatings, catalysis, photonics, integrated optics, microelectronics, decorative coatings, anti-counterfeiting coatings and many more.
Intellectual Property Rights	Patents filed/granted

Picture(s)





Type of partner sought

3D-oxides offers R&D services to develop materials with unique properties and is developing also its own applications

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FRANCE ALLIANCE CONCEPT

Company

Keywords

Materials Processing Technology, Coatings, Optical Materials, Surface treatments

Technology offer Reference: **TO_FR_010902**

Physical Vapor Deposition(PVD) thin films system developer

Technology description	Based in Annecy, Alliance Concept is specialized in PVD systems manufacturing including magnetron sputtering and evaporation. All the PVD systems developed by the company are working in the nanometer range. They are offering a large volume and can accommodate sources and substrates of different dimensions Since 1991 the company has developed a large product range but also realizes very specific systems on customer request.
Innovation features and advantages	Alliance Concept is developing PVD machines available in a wide variety of configurations which can be fully customized according to the client request All systems proposed are built in our factory. Our main goal is to propose high quality and reliable systems with an efficient support.
Current and Potential Domains of Application	**Thin-Film deposition for the following industrial sectors:** Micro-electronics, semiconductors, defence, energy, photovoltaic, optics, watch industry, medical…
Intellectual Property Rights	Not Documented

Picture(s)

DP650 system with a circular chamber diameter 650 mm

EVA760 system with a wide range of complex configurations

Type of partner sought

Business collaboration

EEN Contact

CCI de région Rhône-Alpes
FAYOLLE Etienne
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+33 472 11 43 07

ITALY AL.MEC Srl

Company

Keywords

Composite materials

Know-How Offer
Technology Request

Reference: **KHTR_IT_110403**

Finite element model of soft tissue sandwich from artery to skin

Technology description

AL.MEC is proposing a finite element model of soft tissues from the radial artery wall to the surface layer of skin on the inside of wrist (soft tissue sandwich). A constitutive framework is provided for the characterization of the mechanical behavior of each layer in the soft tissue sandwich, adopting a specific hyperelastic anisotropic formulation in the theory of fiber-reinforced materials. In comparison to existing models for arteries, modifications and additions have been implemented to include a model of the tissues surrounding the artery treated.
The company is looking for an electro-optical non-contact method for heart beat monitoring, based on the measurement of skin surface vibrations caused by vascular wall motion induced by the pumping action of the heart.

Innovation features and advantages

The model prediction of sandwich displacement under physiological pressure allows the extrapolation of the general stretch behavior of the different layers of the biological. The current model can be improved by finite elements suitable for weakly-compressible materials.

Current and Potential Domains of Application

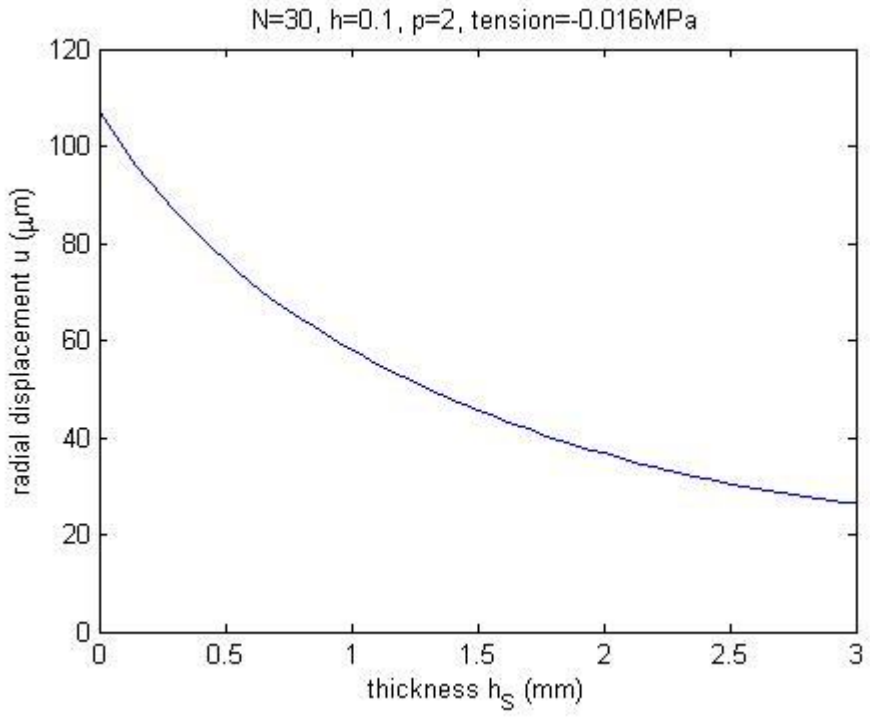
This model represents a first step in the feasibility study to model the interaction between respiratory/cardiovascular system and skin displacement for an eventual contact-free diagnostics application.

Intellectual Property Rights

Secret know-how

Picture(s)

Displacement along the thickness of radial artery and its surrounding tissue at wrist for a systolic pressure about 120 mmHg - N is the number of finite elements and p is their polynomial order



Type of partner sought

Not Documented

EEN Contact

Unioncamere Piemonte
Giulia Valentina Maccario
Email: g.maccario@pie.camcom.it
Tel: +39 011 5669237

SWITZERLAND ANONYMOUS

Company

Keywords

Ceramic Materials and Powders, Materials Processing Technology, Materials testing, Coatings, Surface analysis, Surface treatments

Technology Request Reference: **TR_CH_120204**

Looking for Technology Support in HV Ceramic Insulators, SEEY-reducing coatings, NEG coatings, or HV Stability

Technology description	A Swiss company is developing x-ray tubes to be used in Non-Destructive testing. The development and production of high-power and high-voltage x-ray tubes requires an in-depth knowledge of the physical phenomenons and material properties inside the x-ray tubes. A thorough understanding is required of the insulating ceramics, the secondary-electron-emission yield (SEEY) of all surfaces, the vacuum level, and the triple-point behaviour. The company puts substantial resources into research and the acquisition and industrial usage of knowledge in these domains.
Innovation features and advantages	The Swiss company is interested in general and particular developments in the area of HV-stability of insulators, NEG materials and SEEY-reducing coatings. The Swiss company is interested in optimising the performance and HV-stability of the x-ray tubes by reducing SEE and the vacuum level. Our x-ray tubes go from 75 to 600 kV in a very compact design with typical electrical fields in the order of 10 to 30 kV/mm.
Current and Potential Domains of Application	High power and high-voltage uni- and bi-polar X-ray tubes.

Intellectual Property Rights	Patents filed/granted Copyright(s) registered Secret know-how
Type of partner sought	- SEEY-reducing and flash-over eliminating coatings - NEG-Coatings - HV-compatible insulating materials (ceramics)
EEN Contact	**Euresearch** *Emile Dupont* Email: emile.dupont@euresearch.ch Tel: +41(0)313806034

SWITZERLAND ANONYMOUS

Company

Keywords

Materials Processing Technology, Materials testing, Plastics, Polymers, Properties of Materials, Corrosion/Degradation

Technology and Know-How Request Reference: **TKHR_CH_120205**

Looking for innovative material/material production technologies/also tools-related

Technology description	A Swiss company is actively scouting for innovative techniques and components related to materials and material treatments. Interested in innovative material properties (mechanical and visual) and technology processes. Also of interest: tools for material production/treatment and technologies to create tools for material processing.
Innovation features and advantages	The Swiss company is looking for innovative ideas and technologies that could be adapted to the watchmaking process. Proofs of concepts for materials and technologies are necessary.
Current and Potential Domains of Application	Watchmaking industry.
Type of partner sought	Technological partner Patent license Technological cooperation
EEN Contact	**Euresearch** *Emile Dupont* Email: emile.dupont@euresearch.ch Tel: +41(0)313806034

SPAIN ARRAELA S.L

Company

Keywords

Building materials

Technology offer Reference: **TO_ES_010106**

DEVELOPING NEW MATERIALS FOR RADIOLOGICAL PROTECTION

Technology description

Arraela S.L. is a company dedicated to the development of materials and its implementation engineering. Working areas of the company are: RADIOLOGICAL SHIELDING, THERMAL ENERGY STORAGE, MARINE CONCRETE AND ELECTROMAGNETIC AND THERMAL SHIELDING.
In radiological shielding field, Arraela S.L. has developed different radiological shielding materials for different types of radiation.

For neutron shielding, it has been developed the CONTEK®-RNH mass. This material combines different compounds allowing both slowing of rapid neutrons as capture of thermal ones. The former phenomenon is due to high hydrogen content while the later is due to boron presence in the mass.
To shield against photon and/or electron radiation, two materials have been developed, CONTEK®-RFH1 and CONTEK®-RFH2. The former, CONTEK®-RFH1, is a heavy concrete made using a ferrous aggregate, that reaches a density of 4 g/cm3, twice that of an standard concrete. Second mass, has same shielding properties as CONTEK®-RFH1, but hold out temperatures up to 1200 ºC maintaining its structural capacity. This fact is due to use of an aluminate cement.

Besides, it has been developed an hydrocarbon-based mass, CONTEK®-RFB. Used aggregate depends on what kind of radiation is needed to shield. This is a polyvalent material since it can shield against photons and neutrons beams.

Another kind of material has been developed recently, CONTEK®-RX. The purpose of this one is to shield for in low X-ray facilities, replacing lead sheets usually used.

Developed materials can be manufactured as poured concrete, precast and radiological protection doors, and tailored pieces to build mobile facilities and all kind of special pieces.

Innovation features and advantages	These new materials developed by Arraela are made with non-toxic materials substituting lead, paraffin and polyethylene used in radioactive facilities usually. They present the advantage that they can be made in desired form and volume, and can be used together to optimize radiological shielding and space. Besides, cost of these materials are cheaper than other ones, and placement is not complicated or involves health risks also.
Current and Potential Domains of Application	All type of radioactive facilities that need to be shielded. This includes research centers; radiotherapy, nuclear medicine and radiodiagnostic facilities; nuclear power plants; …
Intellectual Property Rights	Patents filed/granted Secret know-how Copyright(s) registered Exclusive rights
Picture(s)	   

Additional comments	CONTEK®-RNH material, specially indicated for neutron shielding, had been developed to obtain a high hydrogen content, greater than that of an ordinary concrete (2% versus 0.5%) and high boron content (15% approximately), working as borated polyethylene in neutron shielding (for fast neutrons- 100 keV- tenth value layer of CONTEK®-RNH is 5 cm versus 4.5 cm for borated polyethylene). This material has been used to built radiological protection door at "Neutron Pattern Laboratory of CIEMAT, Spain" and to built the vault and the door of a laboratory in the ITN in Portugal. CONTEK®-RFH (version 1 and 2), are made with a high density and a great homogeneity that allows to reach very high values of compression strength (above 50 MPa). This material has been used to build LINAC's walls of Synchrotron ALBA in Barcelona, Spain. This material is polyvalent since it protects against neutrons too with a great efficiency. CONTEK®-RX has been developed to substitute lead in X-rays facilities, and it has been obtained a great attenuation efficiency compared with that of lead.
Type of partner sought	Not Documented
EEN Contact	**Instituto Galego de Promoción Económica (IGAPE)** *Olga Mª Veiga Martínez* Email: ovm@igape.es Tel: 981541033

FRANCE Carnot MICA

Research Organisation

Keywords

Building materials, Ceramic Materials and Powders, Composite materials, Glass, Materials Processing Technology, Materials testing, Coatings, Materials for Magnetic Applications, Optical Materials, Plastics, Polymers, Properties of Materials, Corrosion/Degradation, Rubber, Surface analysis, Surface treatments

Technology & Know-How Offer
Partner search for European project

Reference: **KH_FR_110107**

Elaboration of materials with innovative properties

Technology description

The elaboration of new functional materials with innovative or specific improved properties is the main objective of our industrial and academic programs of research in order to answer to new demands in the always more restricted framework of industrial rules. These priorities can be found in various strategic domains going from health to transportation, energy, chemistry, defense and security.
CARNOT MICA is about 600 researchers and technical staff as well as about 400 temporary employees (mainly PhD students and post-doc).

Innovation features and advantages

The main advantages of our organization is related to the possibility to cover the whole domain from fundamental research to pilots through the partnerships between the various entities (7 academic laboratories and 7 technological centers) that are present in the CARNOT MICA. It is therefore possible to start with the conception of new materials up to the life cycle of all kind of materials. CARNOT MICA can be a partner that offers know-how as well as technical platforms for characterization at all scales (atomic up to macroscopic).

Current and Potential Domains of Application	Also all domains of applications can be looked for, three main strategic domains have been defined : • Materials for transportation and energy with studies incremental innovation as well as new materials and processes; • Materials for health in close relationship with industrial and medical doctors; • Materials for buildings with a specific focus on innovations through materials based on natural materials such as hemp, wood, but also concrete for example.
Intellectual Property Rights	Not documented
Type of partner sought	Not documented
EEN Contact	**Chambre de Commerce et D'Industrie d'Alsace** *Clio BRIVOIS-POUPARD* Email: c.poupard@ALSACE.CCI.FR Tel : +33 (0)3 88 76 42 32

FRANCE CETIM-CERMAT

Research Organisation

Keywords

Composite materials, Materials testing, Plastics, Polymers, Properties of Materials, Corrosion/Degradation, Surface analysis

Know-How Offer Reference: **KH_FR_010108**
Partner search for European project

Consulting and tests for material choices, Engineering of endurance tests, R&D and Projects

Technology description

CETIM CERMAT is a technical center specialized in the field of expertise, measurement and testing.
The center has the status of.CRITT (Regional Center for Innovation and Technology Transfer) and CRT (Technology Resource Center) in advanced mechanics. CETIM CERMAT is partnered with Cetim (Technical Centre for Mechanical Industries).

The center aims at developing competitiveness by controlling value-adding and difference-adding factors.

CETIM CERMAT main areas of expertise are :
- Expert appraisals (metals, corrosion, surface treatments, polymers and composites)
- testing (materials characterization, corrosion resistance, electrochemistry for alloys choice, engineering of endurance tests, tailor-made tests / special tests combining pressure, temperature and speed)
- innovation, consultancy, training, mobile laboratory

Innovation features and advantages

R&D and Projects

- Support with innovation
- Studies, prototypes and testing (thermo-plastic composites)
- Managing multi-skill projects
- Supervising collaborative studies

Current and Potential Domains of Application	**Metallic Materials and Surfaces** Failure analyses Metallurgical examinations Chemical analyses of metals Mechanical tests Corrosion (expert appraisals and tests/simulations) NDC/NDT Mobile laboratory **Engineering of Polymers and Composites** Failure analyses Analysis of polymers and composites Mechanical tests Analysis of VOCs, pollution Mobile laboratory Design of parts in composite parts **Engineering and Endurance Tests** Vibration endurance tests Cycled pressure resistance tests Climatic endurance tests Thermal shocks Integrated, made-to-measure tests, (PVT, urea, micro-cuts, etc.) Internal cabin tests Mechanical tests
Intellectual Property Rights	Patents filed/granted Secret know-how
Type of partner sought	Not documented
EEN Contact	**Chambre de Commerce et D'Industrie d'Alsace** *Clio BRIVOIS-POUPARD* Email: c.poupard@ALSACE.CCI.FR Tel : +33 (0)3 88 76 42 32

FRANCE DMX

Company

Keywords

Coatings, Plastics, Polymers, Surface analysis, Surface treatments

Technology & Know-How Offer Reference: **TKHO_FR_020909**

PVD and PECVD coatings for mechanical applications

Technology description

DMX is a French company located 30 km away from Geneva, specialized in technical coatings elaborated by Physical and Plasma Enhanced Chemical Vapour Deposition (PVD and PECVD). DMX has chosen the PLATIT® technology, a world-renowned Swiss manufacturer of coating units.

Fifteen coatings have been developed in order to increase the performance of tools and components in terms of improvement of friction propeerties and resistance to wear, abrasion, corrosion, oxidation at high temperatures, sticking, etc.

DMX's expertise is also based on:
- mastery of pre- and post- treatment operations (automatic or manual blasting, cleaning, stripping, and polishing);
- know how in machining operations and metal manufacturing applications such as stamping, blanking,…
- know-how in mechanical properties of thin films. DMX has invested in high performance equipments for characterization (scratch tester, tribometer, nanoindenter, optical profilometer).

Innovation features and advantages

Innovative DMX coatings can be divided into two main families:

1. Nanocomposite nitride coatings with improved hardness level, heat and corrosion resistance.

2. New generation of doped DLC coatings with improved tribological and mechanical properties.

	Another advantage of our organization is the capacity to propose dedicated complete study to answer specific customer demands on industrial coatings that cannot be solved with already existing solutions.
Current and Potential Domains of Application	DMX coatings can satisfy a number of applications such as punches, dies, cutting tools, injection molds and moving elements, components, dental implants and medical devices, etc
Intellectual Property Rights	Secret know-how
Type of partner sought	Not Documented
EEN Contact	**CCI de région Rhône-Alpes** FAYOLLE Etienne fayolle@rhone-alpes.cci.fr +33 472 11 43 07

GERMANY

Cryogenic Engineering & Materials Expertise (CEME)

Company

Keywords

Materials testing, Materials for Magnetic Applications, Steel and stainless steel, Non-ferrous Metals and Alloys, Superconducting materials

Know-how offer Reference: **KH_DE_121010**

Materials characterization at cryogenic temperatures

Technology description	CEME is a German company which has set up a device which allow the characterization of materials with respect to tensile, fracture toughness, and fatigue crack growth rate between ambient temperature and down to 4 K (-269 °C).
Innovation features and advantages	The company has developed special high resolution displacement transducers, load cells, and extensometers working at hostile cryogenic temperatures and has set up read out electronics and evaluation software.
Current and Potential Domains of Application	The developed specific transducers are prerequisite for high standard measurements at low temperatures to obtain the necessary mechanical data relevant for materials characterization. The data is necessary for the design of machinery and components working at cryogenic environment such as large superconducting magnets usable for fusion technology.
Intellectual Property Rights	German Patent (Patentschrift DE 3210256 C1) approved and published (27. 10. 1983) about R&D on extensometers working at cryogenics

Type of partner sought	CEME aims at transferring its know-how to companies and research institute CEME is already working with many partners; partners list is available on the following website: http://www.nyilas-arman.de
EEN Contact	**Steinbeis-Europa-Zentrum** *Sabine Mueller* Email: sabine.mueller@steinbeis-europa.de Tel: +497 21 935 19 14

FRANCE Crystal Innov

Research Organisation

Keywords

Building materials, Ceramic Materials and Powders, Materials Processing Technology, Materials testing, Optical Materials, Surface analysis

Technology & Know-How Offer
Partner search for European project

Reference: **RTD_FR_110111**

Technology center for innovation in crystal growth and preparation

Technology description

Crystal Innov offers:

A wide range of services :

- Collaborative development and implementation of crystals, processes and components aiming at being ready to go to the market
- Project hosting (pilote line, demonstrator…) in a high technology building, with all facilities and high level confidentiality
- Services for processing crystals and hard materials
- R&D partnership (e.g. European projects) and sub-contracting
- training

High level industrial equipment for :

- crystal growth (bulk, fiber and film)
- shaping (cutting, wafering, polishing)
- characterization

Access to Crystal innov co-founder facilities (academic labs + industrials)

Innovation features and advantages	- A full service for developing innovative crystals, processes and components for high tech applications : - High performance - High reliability - Use in severe environment / high temperature, radiation resistance Competitiveness (collective technologies, automatisation…) and eco-design (energy efficiency, recycling…) are fully integrated in development
Current and Potential Domains of Application	- Time and Frequency (Time measurement, RF sources, SAW / BAW devices) for aerospace, telecoms and defence - Power electronics for transportation (aerospace, high speed train..) - Optical devices and sensors for environment - High energy detection (astrophysics, research infrastructures)
Intellectual Property Rights	Exclusive rights Secret know-how
Type of partner sought	Industrials : - Producing / processing crystals - Designing and manufacturing machines for crystal processing (furnace, shaping & characterization equipment) - Developing devices made of advanced crystals & inorganic materials
EEN Contact	**CCI de région Rhône-Alpes** FAYOLLE Etienne fayolle@rhone-alpes.cci.fr +33 472 11 43 07

SWITZERLAND CSEM

Company

Keywords

Ceramic Materials and Powders, Composite materials, Materials testing, Steel and stainless steel, Non-ferrous Metals and Alloys, Properties of Materials, Corrosion/Degradation, Surface analysis

Know-How Offer Reference: **KH_CH_110212**

Advanced materials characterization using state-of-the-art microscopy and XRD techniques focusing on the relationship between micro-structural and mechanical properties

Technology description

CSEM is an RTO (Research Technology Organization).

Outstanding characterization methods are developed for microstructural investigation by High Resolution XRD and new non-conventional microscopy.

High resolution X-ray diffraction (HRXRD) is especially dedicated for material structure investigation on the atomic scale. Special in-house developed accessories permit mechanical deformation and the simultaneous study of strain in addition to microstructural modifications. Special high temperature attachments installed on the XRD instrument permit in-situ investigation of microstructural evolution RT up to 1600°C under different atmospheres such as O2, H2, N2, Ar and vacuum. Structural transformations on the surface during the heat treatment can be monitored. Small Angle X-Ray diffraction (SAXS) permits to determine particle sizes and distributions for particles in liquid medias and preventing the appearance of artefacts due to agglomeration often observed in the analysis of dry samples.

Microscopy and Nanoscopy is oriented to micro and nano structural characterization in the field of solid state, physics, material science, life science and, particularly, in Microsystems. Transmission electron Microscope (TEM) having resolution of 0.14nm, Environmental Scanning Electron Microscope (ESEM) equipped with EDS, EBSD, Hot Stage, Peltier, EBIC, Cryo sytem, and AFM with two extra mode Peak

Force and surface electrical conductivity, are the main systems available. A facility such as Hot Stage in ESEM permits in-situ microstructurale study up to 1500°C under different environment and the study of interaction of medias with surfaces. Besides EBIC (Electron Beam Induced Current) imaging, special accessories are developed for the investigation of the influence of electronic irradiation on the charge effect in the materials. Moreover, the AFM peak Force and surface electrical conductivity are especially dedicated for surface investigations. The Peltier stage in ESEM permits the material investigation in 100% relative humidity. Mechanical properties of thin films are measured by a developed Bulge test system.

Innovation features and advantages

Innovation Features:

- In-situ microstructural study under heat treatment and different atmosphers
- Thin film mechanical properties
- Nano particles suspension size and form measurement

Advantageous

- Direct relation between microstructure and macroscopic properties
- Prevent the effect of agglomeration during deposition in the case of nano particle size measurement
- Fine and high resolution new phase formation in nearly first stage of nucleation and growth

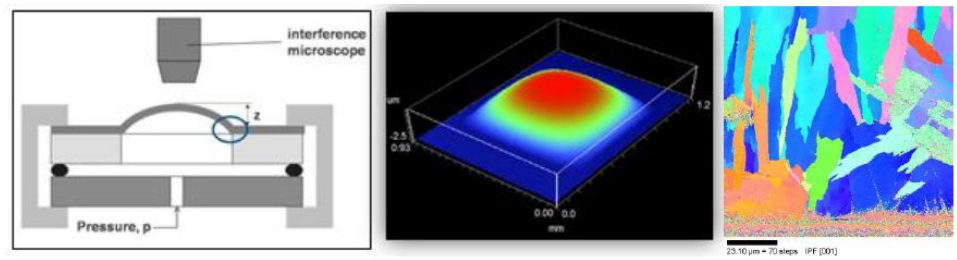
Current and Potential Domains of Application

- Metallic Materials (Ferrous and Non Ferrous)
- Nano particles
- High Temperature materials
- Cryogenic materials
- Thin films

Intellectual Property Rights

Not Documented

Pictures



Bulge test for thin film mechanical properties, EBSD

Systems under investigations, High Temperature XRD equipment

Type of partner sought	Industrial, Research & Development
EEN Contact	**Euresearch** *Emile Dupont* Email: emile.dupont@euresearch.ch Tel: +41(0)313806034

DENMARK Danish Technological Institute

Research organization

Keywords

Colors and varnish, Materials testing, Coatings, Materials for Magnetic Applications, Properties of Materials, Corrosion/Degradation, Surface treatments, Superconducting materials

Technology offer Reference: **RTD_DK_110913**

Materials testing and development laboratory seeking partners in research and industrial applications in materials science and coating development

Technology description

The Danish Technological Institute develops research and technology projects such as:

- A. Innovative industrial coatings. Sol-Gel derived advanced functional coatings (scratch resistance, thermally stable, anti-fouling, and others).
- B. R&D in metal/composite development (incl. magnet material and superconductors) and in functional (lifetime) testing of industrial materials.

Innovation features and advantages

The sol-gel constituted glass ceramic coatings are considered as high durability coatings. It is a simple and cost-efficient way to functionalize and optimize surfaces, hence reduce production downtime or increase a product's performance.

The glass ceramic coatings have many advantages:

- Chemically stabile towards hydrolysis and organic solvents
- Thermal stabile between -196 °C and 250 °C.
- Resistance to thermal shocks
- Good adhesion to almost all substrates
- Highly flexible and bio-compatible

Current and Potential Domains of Application	- Industrial scale anti-fouling coatings for the oil industry. - Stimuli-responsive sensoric coatings. - Optically active coatings. - Drug-integrating organic-inorganic hybrid coatings
Intellectual Property Rights	Patents filed/granted Secret know-how
Type of partner sought	Partners in different industrial application areas are sought
EEN Contact	**Fonden Alucluster** Christian Kjelde Email: ck@alucluster.com Tel: +45 73743040

INTERNATIONAL

European Organisation for Nuclear Research (CERN)

Research center

Keywords

Microelectronics, PCB, materials processing

Technology offer Reference: **RTD_CH_010714**

Innovative chemical etching of multilayered printed circuits

Technology description

The European Organization for Nuclear Research (CERN) has developed a process to obtain size-controlled microvias in multilayered printed circuits, by a chemical anisotropic etching.
First a printed circuit is normally designed, with metallic layer-through vias. Then a metallic covered polyimide thin film is coated with epoxide glue. The substrate and coating are selectively etched by an aqueous solution of ethylenediamide with a certain content of potassium hydroxide (KOH) depending on the film thickness. The results are microvias with a controlled diameter all along the depth, when isotropic etching usually provides an enlarged diameter within the layer.

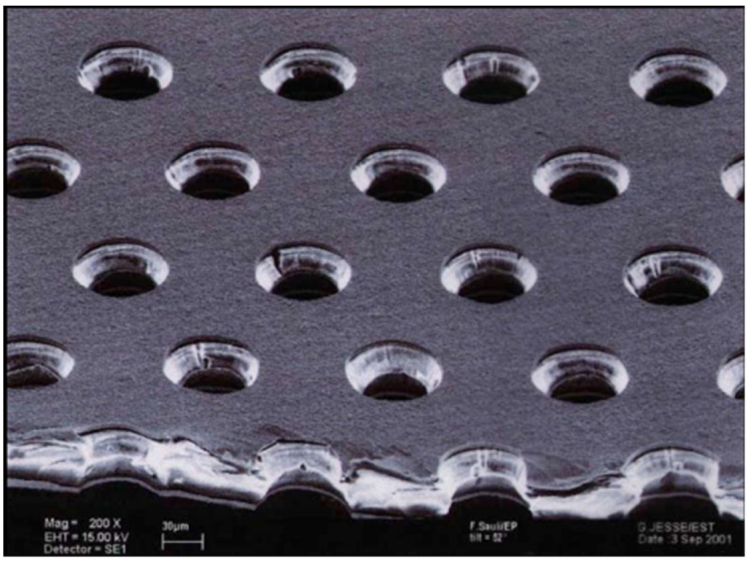
Innovation features and advantages

Innovation features:

- The etching process
- The chemical composition of the etching bath

Advantages:

- All the vias are etched together
- Marginal cost compared to physical techniques (laser, plasma, photo-imaging)
- Controlled dimensions of vias
- Process compatible with all standard PC assembly lines
- Vias of any shape (circle, square, star…) can be produced and standardized
- Vias can have a reduced size (min 40 µm)
- Fast and simultaneous process (9 – 18 min)

Current and Potential Domains of Application	• Microelectronics, semiconductive wafers… • Printed Circuit Board industry • Electron multipliers • …
Intellectual Property Rights	Patents filed/granted
Picture(s)	
Type of partner sought	CERN is looking for companies to transfer the technology to industrial applications
EEN Contact	**CCI de région Rhône-Alpes** FAYOLLE Etienne fayolle@rhone-alpes.cci.fr +33 472 11 43 07

INTERNATIONAL

European Organisation for Nuclear Research (CERN)

Research center

Keywords

Composite materials, Coatings, Heat transfer

Technology offer Reference: **RTD_CH_010415**

Innovative Metal Matrix Composites (MMC) with high thermal and electric conductivity

Technology description

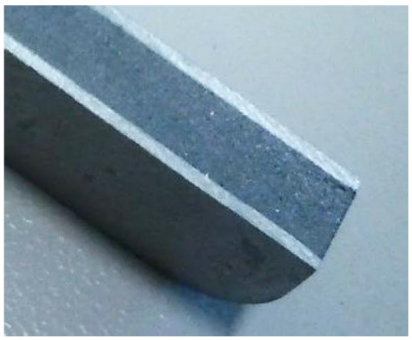
The European Organization for Nuclear Research (CERN) has developed several innovative MMC materials that have both good thermal and electric conductivity. Electric conductivity can also be increased by adding a metallic coating on the MMC surfaces (three-ply sandwich material).
The matrixes are made of Molybdenum (Mo) or Copper (Cu), and the reinforcements are graphite (Gr) or diamond (CD). These composites combine properties of both types of materials. Production techniques include Rapid Hot Pressing (RHP), Spark Plasma Sintering (SPS) and Liquid Infiltration.

Innovation features and advantages

- Applicable for high-temperature environments (melting point of Mo-Gr : 2500 °C)
- Outstanding thermal conductivity (490 – 700 $W.m^{-1}.K^{-1}$)
- Metallic coating increases by a factor of 18 the electric conductivity
- Low Coefficient of Thermal Expansion

Current and Potential Domains of Application

- Thermal management (microelectronics)
- Heat exchanger in refrigerating units or heat pumps
- Fusion engineering
- Advanced braking system in aeronautics or automotive
- Solar energy application

Intellectual Property Rights	Patents granted
Picture(s)	 Mo-coated Mo-Gr sandwich (Brevetti Bizz)  Mo-Gr material (Brevetti Bizz)
Type of partner sought	CERN has sub-contractors that produce this material. Partnership is sought with companies from potential application fields
EEN Contact	**CCI de région Rhône-Alpes** FAYOLLE Etienne fayolle@rhone-alpes.cci.fr +33 472 11 43 07

INTERNATIONAL

European Organisation for Nuclear Research (CERN)

Research center

Keywords

Surface treatments, Radiofrequencies, Magnetization

Technology & know-how offer Reference: **RTD_CH_111916**

Magnetic process to reduce multipactoring in radiofrequency devices

Technology description

The European Organization for Nuclear Research (CERN) has developed a way to reduce the multipactor effect, which produces issues in radiofrequency (RF) devices such as microwave filters in satellites. This effect occurs when an electron is accelerated by an RF system's strong electrical field against a metallic surface. It is linked with the Secondary Electron Yield (SEY) of this surface. To reduce it, the magnetization of a magnetic intermediate layer can be done with a write head. This type of static magnetization pattern should have a similar effect on slow electrons close to the surface, but without the disadvantage of degrading RF losses.

Innovation features and advantages

Innovation features

- Magnetization pattern technique

Advantages

- Simple technology
- Cost-effective
- Nicely compatible with all the stringent requirements for satellite payloads
- No drawbacks like increase of RF losses or long-term stability issues
- Adaptable technology for accelerator beam pipes

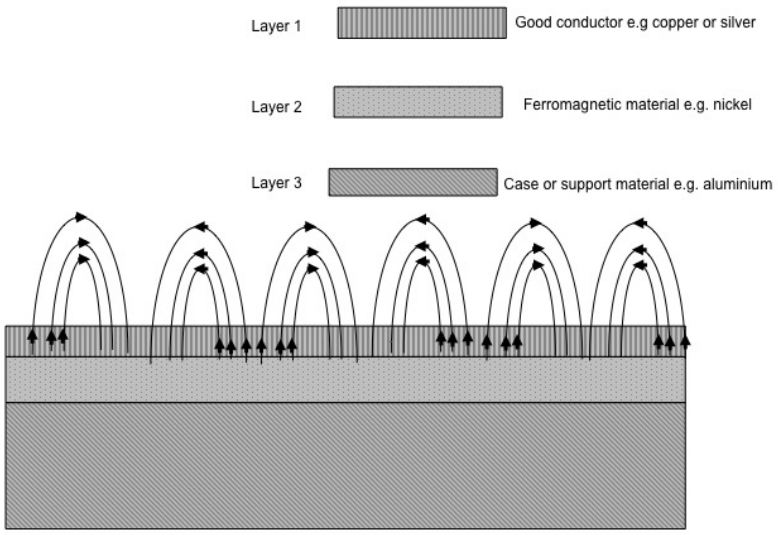
Current and Potential Domains of Application

- Satellite radio-frequency or microwave equipment
- Many kinds of high-power microwave tubes (klystrons) and waveguides
- Particle accelerator components (RF cavities, RF coupler structures)

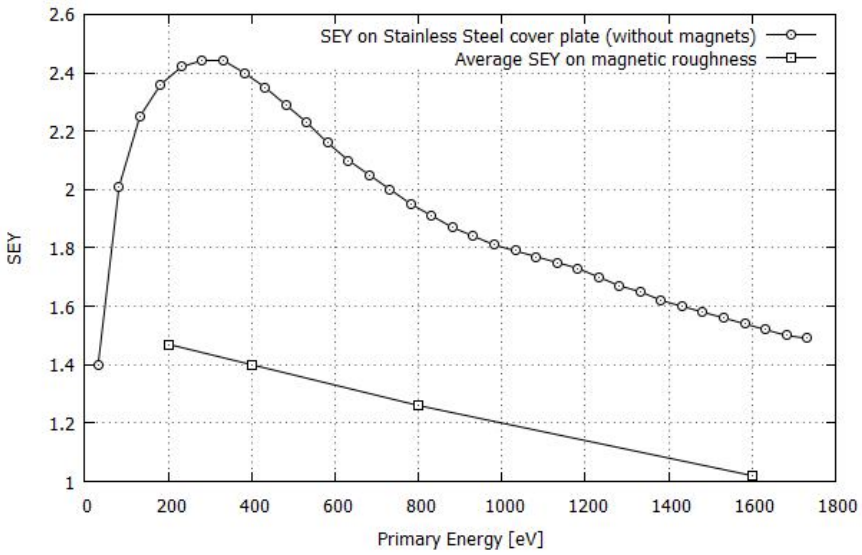
Intellectual Property Rights

Patents filed/granted

Picture(s)



Magnetization pattern in the ferromagnetic layer



SEY reduction in a sample of stainless steel, with respect to an untreated sample

Type of partner sought	CERN is looking for companies to transfer the technology to industrial applications

EEN Contact	**CCI de région Rhône-Alpes** FAYOLLE Etienne fayolle@rhone-alpes.cci.fr +33 472 11 43 07

INTERNATIONAL

European Organisation for Nuclear Research (CERN)

Research center

Keywords

Radioisotopes, Ceramic materials, Nuclear reactions

Technology offer Reference: **RTD_CH_010217**

Nano-structured target for radioisotope production

Technology description

The European Organization for Nuclear Research (CERN) has developed a stable, nano-structured material useful in producing a wide range of radioisotopes with a good process yield.
The nano-structured material is made of Al2O3, Y2O3 or ZrO2. The target is placed within the path of a high energy particles beam (i.e. a proton beam) in order to produce radioactive isotopes via spallation, fission or fragmentation nuclear reaction.
CERN provides technology and know-how on the material manufacturing. Although the separation process is not patented, CERN can provide know-how.

Innovation features and advantages

- Better stability under intense beam irradiation
- Isotopes release faster from the target due to smaller grain size
- Allows production of intense beams and exotic isotope species
- High thermal conductivity due to composite refractory foil / nanograined oxide ➔ high incoming primary beam power allowed
- Superior isotope purity than for other methods of production (such as fragmentation)

Current and Potential Domains of Application

- Nuclear industry (Gen IV fission reactors or fusion reactors)
- Medical: tracers for imaging, radio treatment…

Intellectual Property Rights

Patents filed/granted

Type of partner sought	CERN is looking for companies to transfer the technology to industrial applications

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INTERNATIONAL

European Organisation for Nuclear Research (CERN)

Research center

Keywords

Vacuum, Coatings, Getter

Technology & Know-How Offer Reference: **RTD_CH_010918**

Non Evaporable Getter (NEG) & Palladium thin film coatings

Technology description

The European Organization for Nuclear Research (CERN) has developed an innovative device to improve vacuum level in vacuum chambers and to limit surface desorption.
Getters are materials used to trap these gas atoms or molecules, in order to complete and maintain the pre-existing vacuum. The developed technology is about a multi-element Non Evaporable Getter (NEG) associated to a palladium-silver (Pd-Ag) thin film coating.
The NEG coatings are titanium/zirconium/vanadium alloys produced by sputtering and can recover their chemical reactivity by heating at relatively low temperature, about 180 °C
The Pd-Ag coating inhibits the enclosure desorption without outgassing itself. It also allows obtaining reversible pumping without formation of a thick passivation layer on the NEG.

Innovation features and advantages

Innovative features

- Coating of the getter inside the enclosure
- Additional thin film of Pd-Ag

Specifications

- NEG performance characterized from 20 different types of materials
- Baking range of temperature : 180 °C to 400 °C
- Ultra-high vacuum achieved : 10^{-13} Torr
- Up to 50 venting cycles possible with a marginal performance loss
- Coating of complex shapes, with proper stoichiometry is delicate

Advantages

- Reversible process for hydrogen pumping
- Hydrogen transfer more efficient for lower heating

Current and Potential Domains of Application

- Electron and cathode tubes
- Vacuum thermal insulation at high/low temperature
- Microelectronics
- Heat treatments under inert atmosphere
- Thin layers deposition techniques
- Medical vacuum…

Intellectual Property Rights

Patents filed/granted

Picture(s)

Type of partner sought

CERN is looking for companies to transfer the technology to industrial applications

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INTERNATIONAL

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Keywords

Polishing, Titanium alloys, Electrochemical processing, Surface treatments

Technology & Know-How Offer Reference: **RTD_CH_111219**

Titanium electropolishing process with low electrical consumption and high surface smoothness

Technology description

The European Organization for Nuclear Research (CERN) has developed an innovative electrochemical polishing process to polish titanium and titanium alloys devices, to a high degree of surface smoothness, typically of a nanometer level. The sample is immersed in a chemical bath, and a low voltage is applied to it so that the material is removed from the surface. It is used at CERN to polish electrodes used for very high voltage (in the original CERN Tech offer, it is mentioned "to polish the cavities of the accelerators"), to obtain an ultra-smooth surface and to avoid sparks.

Innovation features and advantages

Innovative features

- The chemical composition of the bath

Specifications

- Temperature of bath: 10 – 30 °C
- Voltage: approximately 10 V – Applied current: 5-14 A/dm²
- Polishing speed: 1 – 2.5 µm/min (order change)
- Achievable roughness: R_a around 0.05 to 0.10 µm

Advantages

- Practically no size limitation on the sample to be polished
- The sample is easy to maintain clean due to low particle adhesion
- The metal can be polished down to the nanometer level
- Efficient detection of flaws in the surface (changes in potential)
- Creates a shiny, mirror-like appearance

- Low power consumption

Current and Potential Domains of Application

- Vacuum technology
- Medical industry: implants, tools
- Jewelleries, spectacles frames, watches
- Aerospace: turbine blades
- Electronics, storage discs
-

Intellectual Property Rights

Patents filed/granted

Picture(s)

A mirror-like degree of smoothness can be reached

Type of partner sought

CERN is looking for companies to transfer the technology to industrial applications

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Keywords

Materials testing

Know-how offer Reference: **RTD_CH_110020**

Consultancy in material selection, development and characterization

Technology description

The European Organization for Nuclear Research (CERN) owns qualified staff, heavy facilities and equipment, and thus can offer a particularly interesting consultancy in the field of materials.
Facilities for material testing are available for in-house applications, including for material characterization at very low temperatures.
Analysis of materials is carried out by a group of specialists, with a specific know-how in:

- Introducing and carrying out research as part of individual studies of materials;
- Performing failure analysis of materials and components;
- Making critical assessments of metallurgical observations and various associated results, producing technical reports and advising on problems connected with materials;
- Suggesting test programs;
- Defining material technical specifications and non-destructive testing procedures;
- Carrying out mechanical test at cryogenic and room temperature.

Innovation features and advantages

Specific know-how in:

- Materials processing and material properties
- Selection and application of materials
- Adapted fabrication techniques based on several decades of experience in material selection

Investigation for the construction of beam accelerators and physics detectors

Current and Potential Domains of Application	• Specification and assessment of materials and processing techniques • Special steels for vacuum and cryogenic applications • Selection and characterization of alloys, tempers and manufacturing processes for specific environments • Characterization of materials at very low temperatures
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INTERNATIONAL

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Research center

Keywords

Ceramic Materials and Powders, Composite materials, Materials testing, Coatings, Non-ferrous Metals and Alloys

Technology or Know-How request Reference: **RTD_CH_010221**

Highly transparent Ultra High Vacuum chambers

Technology description

Highly transparent vacuum chambers are increasingly required in high energy particle physics. In particular, vacuum chambers in the experiments should be as transparent as possible to minimize the background to the detectors, whilst also reducing the material activation. Beryllium is, so far, the best performing material for this application, but it presents some drawbacks such as brittleness, manufacturing issues, toxic if broken, high cost and low availability. In addition, with the next high energy physics accelerator generation such as the Compact Linear Collider (CLIC), the Triple Large Electron-Positron Collider (TLEP), the problem of high cyclic thermal load induced by synchrotron radiation is also raised.

A development work to obtain an alternative material to beryllium with similar performance is being carried out at CERN. Three categories have been defined and considered: raw bulk material, material composites and structural composites. The main functional requirements are: vacuum compatibility (leak tightness, low outgassing rate), temperature resistance (in the range 200-230 °C), transparency, and mechanical stiffness and strength. After beryllium, carbon is the element with the lowest atomic number that is practical for this application; therefore carbon based materials have been considered in a variety of options.

Small samples of different materials have been tested and the study is now focused on aluminium lithium alloys (as a back-up solution), glassy carbon material, carbon reinforced aluminium matrix and carbon fibre reinforced epoxy with an aluminium leak tight coating.

Innovation features and advantages	All considered solutions have to face different difficulties: - Reinforcement with carbon nanotube of glassy carbon to enhance its mechanical properties - Availability of aluminium matrix composite, - Leak tight aluminium coating on Carbon-fiber-reinforced polymer composites
Current and Potential Domains of Application	Research
Intellectual Property Rights	Not documented
Type of partner sought	Looking for research centers/ companies.

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INTERNATIONAL

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Research center

Keywords

Ceramic Materials and Powders, Composite materials, Glass, Materials Processing Technology, Materials testing, Coatings, Materials for Magnetic Application

Technology or Know-How request Reference: **RTD_CH_010222**

Looking for a novel technique to characterize materials for beam intercepting devices as well as to using traditional techniques to characterize at very high temperatures (2500-3000° C)

Technology description

Materials for beam intercepting devices usually undergo extreme static and dynamic thermo-mechanical stresses at high temperatures. A wide range of materials can be used for this application, depending on the beam energy and the function of the device.

Traditional metals and their alloys are usually employed but also ceramics, carbon based material and high density metals are currently explored as they seem to have promising properties for some applications. Typical properties that are required from these materials are low thermal expansion, high conductivity, high or low density depending on the case, thermal shock resistance, good fatigue life, good mechanical properties at high temperatures amongst others. These devices interact directly with the proton beam and usually are required to absorb significant amounts of energy over extremely short times (microseconds). This results into high, rapid temperature increases, and gradients that produce high stresses.

Innovation features and advantages

We require a good characterization of thermo-mechanical properties of several materials over the entire temperature range from ambient to melting point.

As explained above, virtually any material can be of our interest. The selection is made based on preliminary calculations on the operating temperatures, stresses, radio-protection considerations.

The characterization required usually involves curves of physical (density), thermal (CTE, specific heat, thermal conductivity) and mechanical properties (Young and shear modulus, strength) over temperatures from ambient to melting.

Current and Potential Domains of Application	Beam Intercepting Devices (collimators, dumps, targets, scrapers, beam stoppers). These materials are also used in traditional industry but sometimes their thermo-mechanical and physical characteristics are not well known. Hence, thoroughly characterizing these materials can be of benefit for different industries.
Type of partner sought	• Sought are material producers (e.g. casting, forging), institutes/universities with testing/metrology capabilities and experience. • These devices are typical for accelerators (collimators, dumps, targets, scrapers, etc.) but the material technology developed could be extrapolated to all industries where high end materials are required.
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Keywords

Composite materials, Materials testing, Materials for Magnetic Applications, Plastics, Polymers

Know-How offer Reference: **RTD_CH_010423**

Design of high transparency beam pipe supports for LHCb with materials having a strong resistance to radiation and high temperatures

Technology description

Several radiation transparent, organic materials were qualified and used in the structural design of the beam pipe supports for installation within the acceptance region of the LHCb experiment at CERN, for the pending upgrade. Transparent materials have a high radiation length, meaning the likelihood of interaction between incident particles and obstructing atoms is low. The atomic number, Z and atomic weight, A, are therefore lower for more transparent materials.

High radiation doses/rates were considered in the material characterizations, in addition to high temperature qualification, in some cases, because of their use in close proximity to the beam pipe, which requires heating for up to 24 hours to activate the internal sorption surface coating (Non Evaporable Getter).

Beryllium, Polybenzimidazole (PBI) engineering plastic, Technora® para-aramid fibres, and carbon fibre reinforced plastic (CFRP) will be implemented in the new system. Volume optimised beryllium collars will support each beryllium beam pipe via an assembled interface ring in PBI plastic. The collars are loaded in tension by 4 carbon fibre reinforced rods and 4 Technora cables in order to maintain the stiffness of the system and restrict movement of the beam pipe.

The rods and cables employ a diameter-optimised system utilising only the unidirectional properties of the fibres and also employing transparent PBI terminations, around which the fibres are wound for improved safety. A substantial transparency improvement will be realised when compared with the currently installed aluminium collar and steel guy-ropes.

Innovation features and advantages	Advantages of the new design include the significant increase in transparency of the support system inside the acceptance region of the experiment, particularly very close to the beam pipe, where beryllium collars will now be used instead of aluminium. The use of PBI plastic at the beam pipe interface allows the beam pipes to be baked at high temperature with these elements remaining installed. The unique fabrication method of the rods and cables allows the end terminations to be minimised in material volume and avoids the risk of fibre slippage or the failure of glued joints.
Current and Potential Domains of Application	Beam pipe support structures in the acceptance regions of particle detectors. Structural applications in irradiated environments. Applications where the radiation transparency of structural parts is important e.g. satellites, radio antennae, possible medical applications, etc
Intellectual Property Rights	Not Documented
Picture(s)	

Type of partner sought

Partners can supply details of industrial partners for reproduction of developed components.

Partners can supply expertise for reproduction of similar projects.

Interested in improvement of available material properties related to radiation, thermal and creep. Specifically of engineering plastics, alloyed, non-ferrous metals.

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Keywords

Steel and stainless steel, Non-ferrous Metals and Alloys, Properties of Materials, Corrosion/Degradation, Low z material

Technology & Know-How Request

Reference: **RTD_CH_010424**

Looking for thin, leak-tight Al alloy shells and advanced techniques to join aluminum components

Technology description

The Large Hadron Collider experimental vacuum chambers continue throughout the LHC accelerator's main 4 detectors where bunches of particles are colliding. Their overall lengths are approximately between 30 and 42 meters and are made with segments connected together with leak tight flanges.

The choice of material is always a compromise between mechanical properties, transparency to particles, leak tightness and "weldability" for Ultra-High Vacuum (UHV) applications. Optimisation of mass is always a major concern and the final wall thicknesses are between 1 and 3 mm.

Furthermore, for UHV applications, all vacuum chambers need to deal with several thermal cycles (bake out at 180 °C during 24 hrs with slop of 50°C/hrs and Non Evaporable Getter activation) leading to a specific material choice of aluminum alloy 2219 series.

Finally, joining technics such as Tungsten Inert Gas (TIG), laser, and Electron beam welding allow producing leak tight length up to 7 meters.

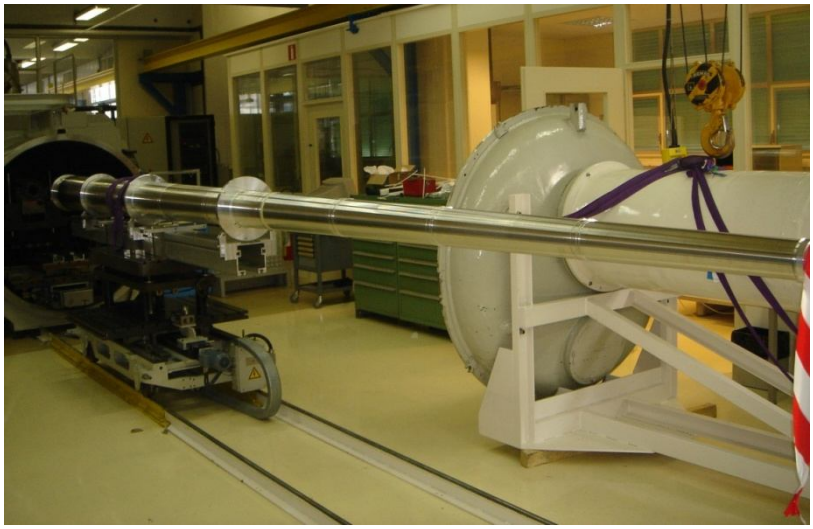
Innovation features and advantages

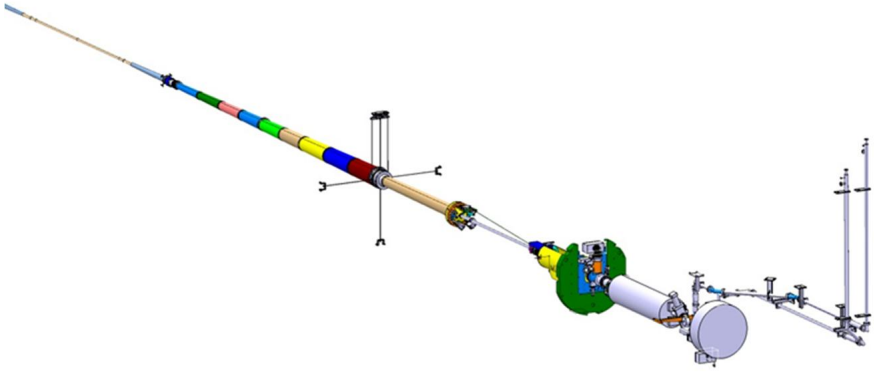
Reduce the number of welds for a pipe segment an therefore risk of potential leaks and deformation

Current and Potential Domains of Application

Accelerator components
Light & leak tight tank

Picture(s)





Type of partner sought

CERN is looking for aluminum alloy suppliers who can supply 2D forged semi product (bars, hollow jet etc.) with a length in the range of 4 - 5 meters

CERN is looking for companies with knowledge of machining long thin wall tubes or cones (range of 4 meter) and/or knowledge of welding technics as electron beam, TIG, laser process with, if possible, in-house expertise to perform nondestructive testing such as ultrasound or radiography.

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Research center

Keywords

Material characterization

Know-How offer Reference: **RTD_CH_110125**

High-Radiation to Materials (HiRadMat) Facility of CERN/SPS for material analysis

Technology description

The European Organization for Nuclear Research (CERN) operates the HiRadMat (High-Irradiation to Materials) facility providing high-intensity pulsed particle beams to an irradiation area where material samples as well as component assemblies can be exposed.

Not necessarily restricted to particle accelerator applications, beam time can be requested by any group world-wide. CERN operates the accelerator complex including the Super Proton Synchrotron (SPS) and HiRadMat@SPS. CERN support to experiments includes the basic infrastructure for the experiments (electricity, network connectivity, office space, connections, some technical support etc.), installation of the experiments, preparation of the beams, and the beam operation during the experiments.

The beam in the HiRadMat Experiments is provided free of charge to CERN users and external users. HiRadMat is participating in the EU framework program EuCARD2, where limited funds provided by Transnational Access are available to eligible users for covering travel/subsistence expenses connected to HiRadMat experiments.

More details of the facility layout and contact/application information can be found at http://cern.ch/hiradmat.

Innovation features and advantages

The dimensions of the irradiated objects are flexible, so both and thin material objects can be placed. The only restriction comes from the size of the facility (transport), so the objects can be up to 2 m high, 2 m wide and up to 7 m long.

Current and Potential Domains of Application

The initial intention for this facility is the characterization of material properties, such that the material behavior can be described when exposed to the particle beam resulting in an sudden deposition of large energy amounts within the micro-second scale. Both, basic material properties and the behavior of assemblies are studied.

On the accelerator machine protection, an experiment investigated the impact of a loss of the full LHC beam on solid materials. Solid copper cylinders (see Figure 2) were exposed to the SPS proton beam investigating the beam tunneling effects and benchmarking of numerical models. For the investigation of material properties, twelve different candidate materials for beam intercepting devices like collimators, in a fully instrumented setup using fast photography, laser Doppler vibrometer and strain gauges measurements, allowed comparing the measurement data with advanced numerical models.

In another approach using the HiRadMat beam, two experiments used the beam impact on the dump and the generated radiation field. Firstly the functional test and calibration of a new type of beam loss monitors (BLM) designed to extend the dynamic range to higher radiation fluxes. The second exposed five radiation detector types to the generated neutron field for inter calibration but also to compare their performance and capacity to detect high-intensity radiation bursts.

Pictures

Figure 1: Remotely controlled installation of an experiment on the target position. A standardized cage (metal bottom with frame) hosting the experiment (central aluminum box on foot) is moved using the overhead crane. The final position is determined by the black pins on the fixed installation. Automatic connections for electrical lines and cooling circuits allow a fully remotely guided installation and removal of the experiment, an important feature in such environments with radio-active material.

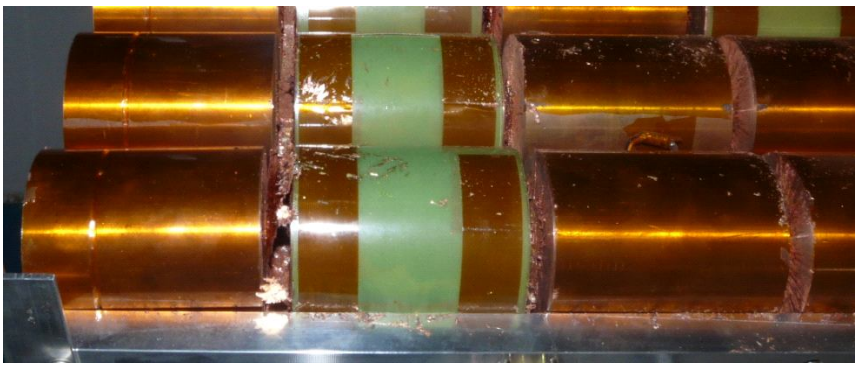

Figure 2 (courtesy R. Schmidt et al.): Copper cylinders (10 cm length) were exposed to the HiRadMat beam. On the front faces of the copper cylinders one can recognize the beam impact point, where melt copper solidified again in a star pattern caused by the thermal expansion.

Type of partner sought	CERN HiRadMat is open to industrial, commercial and research institutions using the facility for new application domains.
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INTERNATIONAL

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Keywords

Non-ferrous Metals and Alloys

Know-How offer Reference: **RTD_CH_011226**

Material and fabrication challenges of superconducting accelerating cavities

Technology description

More and more new accelerating structures are based on radio frequency superconducting cavity technology. The cavities are 704 MHz bulk niobium beta=1 elliptical cavities, operating at 2 K with a maximum accelerating gradient of 25 MV/m. In order to reach the constringent tolerances for a high performance of the cavities, materials of unique properties are required. The manufacturing and forming of these materials is a technological challenge which requires a very detailed quality control to assess if the material fulfills the technical specifications specially designed for the accelerating cavities. Innovative joining techniques of the cavity itself and for the cavity – tank interfaces will be assessed and developed.

The idea now is to test the weld in the real geometries (this is, weld a tube to a flange).
For the brazing, new filler metals could be studied in order to reduce the brazing temperature

Innovation features and advantages

Improvements in superconducting cavity technology concern:

- Niobium – titanium electron beam welding
- Niobium – stainless steel vacuum brazing

Challenging aspects concern the joining, forming, tuning etc. at the transitions between dissimilar materials.

Current and Potential Domains of Application	For the moment, the domain of application is exclusively the manufacturing of accelerating cavities. There are some niobium alloys used in aerospace and even nuclear industry, but ultra-high purity niobium is exclusively used in accelerating cavities Niobium welding and brazing might be relevant to the nuclear industry
Intellectual Property Rights	Not Documented
Type of partner sought	Not Documented

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Keywords

Materials testing, Materials for Magnetic Applications, Steel and stainless steel, Non-ferrous Metals and Alloys

Know-How offer Reference: **RTD_CH_110827**

Experimental study and constitutive modeling of discontinuous plastic flow in austenitic steels at very low temperature

Technology description

Several metals and alloys, characterized by the Face-Centered Cubic (FCC) lattice, submitted to deformation at temperature near to absolute zero exhibit the phenomenon of Discontinuous Plastic Flow (DPF). The DPF, reflecting the effect of Dynamic Strain Ageing (DSA), is described by the mechanism of local failure of Lomer-Cottrell (LC) locks under the stress fields surrounding pileups of edge dislocations. During tensile straining at cryogenic temperature, each massive release and motion of dislocations is represented by a stress response defined in four stages accompanied by sudden increase of the strain rate and local rise of temperature. The constitutive model of the DPF, well assessed for copper and copper alloys, has been expanded with the experimental data arising from recent campaigns of tensile tests carried out on low carbon austenitic stainless steel 316LN and high Mn-bearing stainless steel JK2LB (low carbon and low boron JK2) samples immersed in liquid helium (4.2 K). These are alloys nowadays commonly used in structural components for magnet systems. Model parameters have been identified and a comparison of results is provided between the two grades, similar in a steelmaking, extrusion and drawing process as well as very comparable in terms of microstructure (inclusion, grain size, fully austenitic structure).

Innovation features and advantages

The unique experimental set-up developed at CERN, already highly performing with the high acquisition rate, was further developed and improved. Results presented in this paper were obtained by force measurement based on internal load cells, the linear variable displacement transformer (LVDT) extensometers and temperature sensor placed on the sample inside cryostat during the test. New accurate results, based on a large number of tests and optimized data acquisition, allow the existing DPF model to be verified and calibrated for use with high strength steels and

	alloys used in cryogenic environment.
Current and Potential Domains of Application	LHC (Large Hadron Collider) and fusion superconducting magnet systems, as well as all present and future systems, working at very low temperature
Intellectual Property Rights	Not Documented
Picture(s)	
Type of partner sought	Not Documented
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Keywords

Materials testing, Materials for Magnetic Applications, Non-ferrous Metals and Alloys, Magnet Technology

Technology & Know-How offer Reference: **RTD_CH_110828**

Development of novel aluminum-based stabilizer solutions for superconducting cables, applicable to future detector magnets

Technology description

For future high-resolution particle physics experiments, wide bore, high-field magnets are being developed. The self-supporting magnet structure needs to sustain the large electromagnetic force as a result of the high peak magnetic field, requiring for the conductor to exhibit challenging mechanical properties.

A prototype for a 60 kA critical current, at 5 T class stabilized superconductor, operating at 4.2 K is produced by co-extrusion of a large, 40-strand Nb-Ti/Cu superconducting cable with a precipitation type Al-0.1wt%Ni stabilizer. The stabilizer increases the minimum propagating zone while in the mean time decreasing the peak temperature in the superconductor in case of a quench. Micro alloying the high-purity aluminum stabilizer with nickel contributes to its strength, while avoiding significant degradation in residual resistivity ratio (RRR), owing to its low solid solubility in aluminum.

Sections of the conductor have been work-hardened in order to confer mechanical properties and partially annealed to account for the resin curing cycle after coil winding. The mechanical and transport characteristics as a function of the amount of work-hardening and applied annealing cycles have been determined by removing samples after every subsequent step.

Innovation features and advantages

Future detector magnet design calls for the development of next generation large size Al stabilized NbTi superconductors exhibiting high yield-strength for coping with large stresses in wide bore magnets with magnetic fields up to 6 T. Here a first step towards future particle experiment magnet application is presented, by a process scale-up to a 60 kA at 5 T, 4.2 K class conductor. A continuous co-extruded Al-0.1wt% Ni stabilized conductor has been produced with a cross-section as large as 700

mm2.
Subsequent work hardening and annealing cycles lead to the identification of an optimal hardening, and consecutive thermal treatment, which could possibly coincide with a suitable thermal cycle for coil resin curing.

This novel aluminum-based stabilizer solutions is beneficial for the following materials' properties:
- high yield-strength for coping with the large hoop stress in large bore size, high current magnets
- optimal properties at low temperature in both thermal and electrical, as well as mechanical terms
- optimal hardening of the material by cold-rolling without losing thermal and electrical properties

Current and Potential Domains of Application

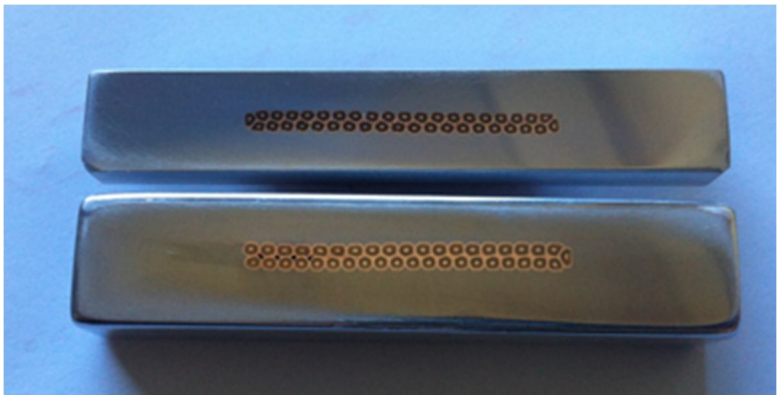
For future generation high-resolution particle experiment magnets

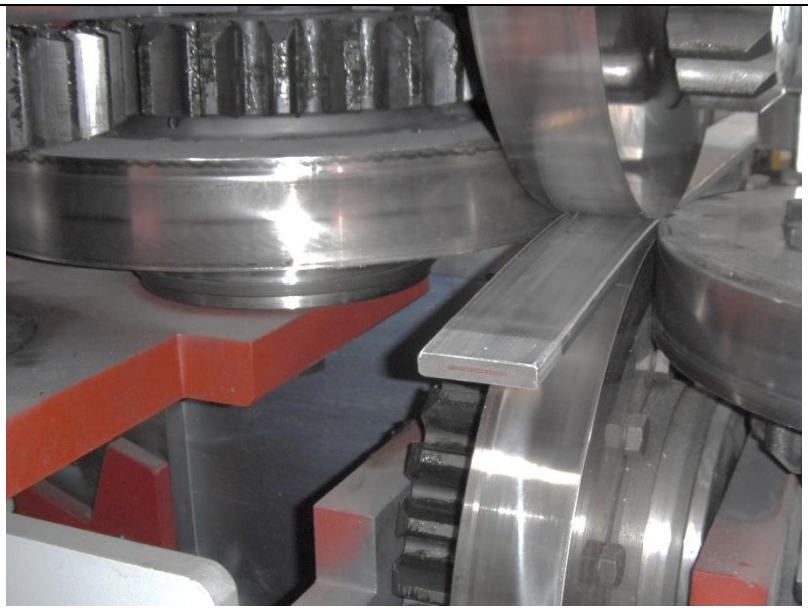
- Applicable to large bore size magnets in the medical industry, like MRI magnets
- Applicable to overhead lines for electricity as the material exhibits both excellent electrical as well as mechanical properties

Intellectual Property Rights

Not Documented

Picture(s)





Type of partner sought	Not Documented

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Keywords

Ceramic Materials and Powders, Composite materials, Coatings, Materials for Magnetic Applications, Steel and stainless steel, Non-ferrous Metals and Alloys, Properties of Materials, Corrosion/Degradation, Surface analysis, Superconducting materials

Know-How offer Reference: **RTD_CH_110229**

High-precision microscopic techniques to analyze materials and scientific support

Technology description

The lecture will briefly describe all microscopy techniques available in metallurgy section and show examples on samples studied for different CERN projects. Scanning electron microscope at CERN is equipped with Field Emission Gun (FEG) source that provides high-energy beam of electrons. The electrons interact with atoms in the sample and produce various signals. Detectors for secondary (SE), back scattered (BSE), characteristic X-rays (EDS) and electrons back-scattered diffraction (EBSD) are attached.

Secondary electrons interact with atoms close to the surface of the sample and reveal its topography with high depth of field. Back-scattered detector reflects elastic scattering from the sample and compositional images are formed. Imaging with BSE detector is often used in analytical SEM together with the EDS spectra. EBSD is micro structural – crystallographic technique to measure grain size, orientation and texture of any crystalline material. Grain size, morphology, topography, phase distribution, chemical composition, grain orientation and texture can be analyzed. Scientific support is possible for any material development, production and failure analysis.

Innovation features and advantages	**Advantages** Reach the micron – nano level of materials structure and chemical composition; texture and deformation of materials. **Requirements** Conductive materials compatible with high vacuum or non-conductive materials coated with C/Au layer.
Current and Potential Domains of Application	Characterization of defect, quality control, morphology, chemical composition, grain size and texture, grain orientation, inhomogeneity's, analysis of trace element that can lead to failure and/or corrosion and others.
Type of partner sought	Sought are universities, industry – automotive, aerial, watch, steel, material development, biology…
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INTERNATIONAL

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Research center

Keywords

Materials Processing Technology, Coatings

Technology Offer

Reference: **RTD_CH_020972**

Application of thin film coatings on complex geometries

Technology description	For complex geometries we developed thin film deposition layout to be able to make uniform coatings within the tolerances of the applications.
Innovation features and advantages	Non standard sputter-target configurations Procedures of several independent coating processes to coat complex shapes
Current and Potential Domains of Application	Coatings on ceramics to reduce multipacting and impedance. (RF and Beam instrumentation). Coatings with low secondary electron yield to suppress multipacting. Niobium thin films for superconducting RF cavities.
Type of partner sought	Not documented
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Materials Processing Technology, Materials testing, Industrial machinery/processes

Technology Offer Reference: **RTD_NL_120730**

Method and apparatus for testing materials

Technology description

The European Space Agency (ESA) is interested in licensing a method and apparatus to perform tests on materials.
Said device can be described as a sealed container able to ensure tight contact between edges of the opening and a portion of the surface of a material being tested. This setup is superior to prior art, as it doesn't restrict user access to the test piece and maintains the test environment isolated to prevent its contamination and mitigate potential hazards to the user (toxic, explosive or flammable environments). License agreement is sought.

The knowledge that this offer is based on describes a device to perform stress tests on a given part, while subjecting that part to a harsh environment that simulates as closely as possible real world exposure. This technology was developed for testing rocket fuel containers, as they are exposed to very toxic and dangerous chemicals, and therefore impossible to safely and accurately test otherwise.

Environmental testing of materials involves exposing a test piece of a material to a specific environment (chemical, thermal, etc.) in order to reveal any adverse effects on its properties. One of the properties of the material that needs to be analyzed is its ability to withstand propagation of an existing defect, e.g. a surface crack. To do so, it is necessary to be able to subject the test piece to mechanical stresses and to observe defect propagation, which requires the test piece to be accessible during testing.

Prior art testing methods fall short when the previous requirements have to be combined with the necessity to expose the piece to a test environment that is corrosive, toxic, flammable, and/or likely to be

contaminated in order to better mimic real world conditions. In aforementioned tests it was only possible to have the test sample in a leaktight receptacle, guaranteeing the environment fidelity and safety, but making the sample inaccessible for interaction and testing during the exposure, or to carry out tests on a test piece in which a portion of its surface is exposed to a flow of testing liquid or gas. In that way the test piece can be accessible in part during the test, but the characteristics of environment are difficult to control and cannot reproduce the real conditions encountered on a mechanical part while it is in use.

This innovation provides a method of testing that does not present these drawbacks, comprising of a receptacle provided with an opening with means for leak tight contact between the edges of said opening and a portion of a surface of a test piece of a material disposed outside the vessel. The described device is equipped with a drainage system and can include means for optical inspection of the test piece and also for the application of mechanical stress to the sample (traction stress in parallel direction). The described setup allows the exposure of the sample to a sealed and therefore pristine environment, while performing the necessary stress tests. After the procedure, the potentially harsh chemicals can simply be drained and the sample is free for any further testing required.

Innovation features and advantages

When compared to prior art, the described product and method are quite innovative as they allow the testing of a given sample in previously impossible conditions, such as keeping said sample accessible for stress testing while avoiding the test environment contamination or exposure to the noxious chemicals.

The apparatus is robust enough to allow the testing of liquid, gaseous or solid environments, being also equipped with a special groove that retains an unsoiled portion of the testing agent for analysis purposes. As for the opening of the chamber contacting with the surface of the test piece, it is engineered to be leak tight, providing an adequate seal.

Current and Potential Domains of Application

Even if it was developed within the space field material testing applications, this method and apparatus may be applied more generally to materials and chemistry corrosion testing of materials. It could be used in material testing laboratories, e.g. aerospace in general, chemical and oil industry.

	It is particularly suited when the environment being tested requires extra caution from the user, either because they are highly susceptible to contamination, or because they are toxic or otherwise dangerous.
Intellectual Property Rights	Patents filed/granted
Type of partner sought	- Type of partner sought: Industry. - Specific area of activity of the partner: Industrial Equipment and Machinery, Material industry, Chemical Industry, Oil Industry, Aerospace Industry. - Task to be performed by the partner sought: industrialize the described technology.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Coatings, Colors and varnish, Electronic, components

Technology Offer Reference: **RTD_NL_020931**

New Antistatic Paints providing Antistatic Protection and Radiotransparancy

Technology description

A new generation of anti-static paints for use on floors, which avoids the need to use metallic wire mesh, has been developed for space activities (launchers and satellites). This coating can be usefully exploited in industrial environments where electrostatic discharges could cause damage to electronic equipment or pose a danger to health.

The anti-static system is achieved by applied the following composite structure to clevis cement or concrete :
1 coat of primer.
1 bonding strap.
1 antistatic black coat.
2 coats of antistatic coloured top-coat.
1 coat of antistatic enamel varnish.

Approved applicators and coating instruction are only available from the donor technology company.

Innovation features and advantages

Special characteristics of the Paints are:

- Prevents floors from accumulating electrostatic charges and ensures their discharge to earth. Glossy aspect.
- Paint is available in sand, light green, light grey, brown red.
- High chemical resistance (diluted acids and bases).
- High mechanical resistance.

Current and Potential Domains of Application	This coating can be effectively used to: eliminate the risk of fire and explosion in the manufacture of explosives, paints and other inflammable products enhanced equipment reliability through effective discharge of electronic equipment and computers as used for example, in patient critical care and safe- guide humans against electric shocks due to electrostatic discharges.
Type of partner sought	Collaborations and new applications are sought.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Coatings

Technology Offer Reference: **RTD_NL_020932**

POLYMET – advanced materials

Technology description

Variations of basis materials, coating metals and designable surface structures allow for composite materials which are resistant to tearing, conductive, resistant to temperature and almost chemically resistant and thus result in innovative new products.
POLYMET is a flexible solution for innovative surface structures. Completely new surfaces are created by galvanotechnical metallizing of high- tech fabrics. By metallizing - enveloping coating - fabrics based on an endless three-dimensional polymer structure are furnished with specific, geometric and microporous metal structures up to micrometer dimensions with high stability.
This new compound material is applicable in microchemical systems due to its variably designable metal coating.

Innovation features and advantages

In comparison to the usual technologies present on the market, POLYMET offers decisive technical advantages in economical as well as ecological aspects. Due to the specific adjustability of the microstructure POLYMET is a versatile designable new compound material with completely new functional properties. Characteristic for POLYMET is its high resistance to tearing, its resistance to temperature and its high recycling potential. Furthermore it is conductive, free of pollutants and almost chemically resistant.

Current and Potential Domains of Application

POLYMET is suitable for high capacity batteries, fuel cells, filters and efficient catalysts as well as for air regeneration systems which have already been tested for use in space applications. The material applicable in innovative battery production

Type of partner sought	The company is interested in customers and/or cooperation partners, also for joint projects and development activities. The company offers the possibility for joint or order specific developments, series production or by licensing agreement.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Coatings, Properties of Materials

Technology Offer Reference: **RTD_NL_020933**

Friction Reduction by DICRONITE® Dry Lubrication Technique

Technology description

The technology provider, located in Germany offers DICRONITE® dry lubrication, a widely applicable dry lubricant that is firmly bonded to the surface. With an unmatched, ultra-low coefficient of friction, DICRONITE prevents wear, reduces energy conversion into heat and provides lubrication without contamination. DICRONITE can be combined with other layers, such as CrN or CrC, adding high hardness and corrosion protection. These combinations, provide surface properties that are independent of those of the base material. The company is capable of coating components up to a size of 600 mm x 800 mm and a weight of 250 kg at short notice. The maximum length for linear guides is 3m.

In the DICRONITE technique a pre-treated surface is bombarded with a specially modified lubricious particle (tungsten disulfide) which is implanted into the atomic grid structure. The process causes a molecular bond and thus a high adhesion to the surface. The process takes place at room temperature with high speeds in the presence of conditioned air as carrier medium. To enable the physical bonding of the dry film lubrication, the surface of the component to be coated is pre-treated to achieve an atomically clean structure free of oxides and impurities.

The dry lubrication film created with the DICRONITE technique has a layer thickness of approx. 0.5 µm. It prevents direct contact of the friction partner's metal surfaces and therefore acts like an oil film. Furthermore, the layer has an extremely low friction coefficient of µ = 0.030 (only half as large as that of graphite with µ = 0.073), thus preventing excessive friction, heating and wear caused by galling. Due to the manufacturing process, the coating becomes part of the surface and can only be removed by removing a portion of the substrate itself.

Due to CrN or CrC which offer high hardness and corrosion protection, surface properties can be realised that are independent of those of the base material. Thus, corrosion resistance, surface hardness and friction sensitivity can be neglected in the choice of the base material, since these requirements are covered by the coating.

Innovation features and advantages

- Due to molecular bonding the dry lubrication layer is permanently fixed to the surface
- Extremely low friction coefficient of μ = 0.030
- The layer prevents the formation of deposits, offers less chances for adhesion and is therefore easier to clean
- The ultra-thin coating is applicable on all metallic surfaces and also suitable for high vacuum applications
- Virtually no limit to the working temperature: with an operating range of -188 °C to +538 °C under normal atmosphere and > +1300 °C in vacuum, many applications can be covered
-

Current and Potential Domains of Application

Among others, the offered technique is suited for applications in the fields of :

- engine and drive technology
- precision engineering
- ultra-high vacuum technology
- plastics processing
- optics
- clean room technology
- medical technology
-

Examples of components to be coated are:

- parts of injection moulding tools to minimise wear and to reduce the release energy of the mould
- joints, hinges, ball bearings and ball bearing guides (also if already mounted), engine and drive components in motor racing
- screws and other fastening elements made of critical materials (titanium, aluminium, VA)
- movable micro-components for precision instruments

Type of partner sought	The company is interested in the execution of coatings on commission. The company is capable of coating components up to a size of 600 mm x 800 mm and a weight of 250 kg at short notice. The maximal length for linear guides is 3 m. Furthermore, new application areas can be developed in cooperation with other coating companies.
Additional Comments	RoHS compliant Biocompatible per ISO-10993 Compliant with SAE AMS 2530 and DOD-L-85645C
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Building materials, Plastics, Polymers

Technology Offer Reference: **RTD_NL_011534**

Elastomers to Protect Devices from Pyrotechnical Shocks

Technology description

A French company has studied, developed and produced new specific viscoelastic elastomers providing very high damping performances. These elastomers have found immediate applications to protect space devices from pyrotechnical shocks and vibrations and the company has studied, designed and manufactured various damping devices for space activities such as Ariane V, Ariane IV, ISS, ATV and various satellites/applications for CNES and large space companies. These elastomers provide low outgassing values compatible with space requirements. These elastomers are processed by vulcanization like any other elastomer.

Innovation features and advantages

These elastomers found full efficiency in space applications demanding maximum damping following numerous uses such as:

- shocks and impacts
- pyrotechnical shocks
- vibrations
-

Acting these elastomers on flexural and shear modes maximizes its exceptional damping properties. The temperature range of use of these elastomers covers from -50°C to +120°C continuously. These elastomers exist in various hardnesses from 40 to 80 Shore A.

Current and Potential Domains of Application

This space technology could be used for numerous markets, for example mass market applications such as:

- Bicycle
- Hi-Fi
- golf equipment

- skis
- damping sole for shoes
- mobile phone (protection of embedded electronics)
- or for professional applications:
- aeronautic (aircraft and helicopter)
- oil and gas industry (incl. drilling)
- chemical and Petrochemical applications
- nuclear power
- Formula 1, automotive sports.

Type of partner sought	The company is interested in the execution of coatings on commission. The company is capable of coating components up to a size of 600 mm x 800 mm and a weight of 250 kg at short notice. The maximal length for linear guides is 3 m. Furthermore, new application areas can be developed in cooperation with other coating companies.
Additional Comments	These products are available on demand with no specific study. A range of products may be manufactured according to technical specifications. Most sizes and forms accessible for standard elastomers are available (ring, ball, plate, ...). Samples may be asked for tests and qualifications.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Materials processing technology

Technology Offer Reference: **RTD_NL_010735**

Super Plastic Forming (SPF) combined with Diffusion Bonding

Technology description

The technology provider is one of the worldwide leading companies for Super Plastic Forming (SPF). For manufacturing integral constructions SPF can be combined with diffusion bonding. Application of these up-to-date forming technologies allow for completely new innovative solutions and savings by means of higher component integration, reduced material thickness and economic processes.

For manufacturing integral constructions SPF can be combined with diffusion bonding.

SPF technology:
SPF (Super Plastic Forming) is a process for the economic production of thin-walled three- dimensional objects made of aluminium, titanium and steel alloys. The characteristic of SPF is an extremely high flowability. Titanium reaches this condition in a hot press when heated up to 900 °C. Under comparatively low gas pressure, the material forms over the shape of the forming die. Ex- tremely thin-walled but rigid designs are possible. The process is governed by specifically devel- oped SPF-parameters and an advanced tooling concept. This method allows to adjust the panel thickness as required.

SPF/DB technology:
SPF/DB (Super Plastic Forming/Diffusion Bonding) is a process for the economic pro- duction of three-dimensional objects and sandwich structures made on titanium. A separating agent is placed on defined areas between titanium sheets. T emperatures of over 900 °C and gas pressure are applied and the unmasked areas are bonded by DB. The flat sandwich is inflated - integrated webs are formed by SPF.

Innovation features and advantages	Application of these up-to-date forming technologies allow for completely new innovative solutions and savings by means of higher component integration, reduced material thickness and economic processes. The essential advantages are: **SPF units:** greater design freedom for high performance aluminium, titanium and steel alloys thin-walled, more complex spherical three-dimensional objects made of high-strength materials higher economic value by lower tooling costs and material reduction. **SPF/DB units:** three-dimensional objects with component integration of highest complexity greater design freedom integrated SPF/DB process reduces stages of production.
Current and Potential Domains of Application	Amongst others, application of the process is possible for: - special vehicle construction, small series such as racing cars, prototypes, emergency vehicles - off-Shore applications - engineering, e. g. of heat exchangers - chemical industry - medical engineering
Type of partner sought	Offered are services of consulting, engineering, development and production of individual items, prototypes and small series for all forming processes for titanium, steel and aluminium alloys.
Additional Comments	These products are available on demand with no specific study. A range of products may be manufactured according to technical specifications. Most sizes and forms accessible for standard elastomers are available (ring, ball, plate, ...). Samples may be asked for tests and qualifications.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Materials processing technology

Technology Offer

Reference: **RTD_NL_010736**

Hall Effect Plasma Sources for Etching and Coating

Technology description

The Hall Effect (HE) is widely used for electric propulsion in space since the ’60 of the last century, thanks to the former Soviet Union missions. More recently, a HET (Hall Effect Thruster) has been used for the SMART-1 ESA mission to the Moon, succeeding in moving the spacecraft for more than one year. Alta has worked on HET for many years, and its HT-100 is the smallest HET thruster in Europe (less than 10 cm in diameter for the assembled system), and the only not relying on Russian patents or heritages. Besides the obvious space applications, Alta has investigated possible ground industry application for Hall Effect technologies, and within the various possibilities the most promising are plasma etching and material coating.

Innovation features and advantages

HE plasma sources represent a technology that can be effectively applied to etching and deposition industrial processes. HE can sustain power densities up to 30W/cm2 compared to the typical 10W/cm2 of a magnetron process; they can generate very high energy plasma flows (up to 350 eV) with high current densities (up to 1 A/cm2), more than 10 times the typical densities of a industry gridded ion source. Advantages on the magnetron and normal ion sources came from the rugged, compact design of the modified HE source and of the complete system. HET systems can work with Xenon, Krypton or Argon as a feeding gas, in relatively low vacuum conditions (about 10-3mbar).

Current and Potential Domains of Application	HE sources could be used in various industrial scenarios: Coupled with existing magnetron systems, to increase the sputtering and/or plasma vapour deposition (PVD) processes; As a replacement of gridded ion sources in processes of ion implantation; In complex, combined plants in which different processing steps (plasma cleaning of a surface, ion sputtering, ion etching …) could be attained by a single ion source.
Type of partner sought	Not Documented
Additional Comments	Alta can provide the ion sources in different configurations and powers, from 100W to 5kW. Small custom plants have been designed and realised for a variety of purposes.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Building materials, Composite materials

Technology Offer Reference: **RTD_NL_010137**

Advanced Materials & Ceramic Matrix Composites

Technology description

The fibre reinforced preceramics have all advantages that fibre reinforced plastics show. Furthermore, these fibre reinforced preceramics have synthetic characters until 500°C and pseudo synthetic characters until 3000°C (Vacuum). The company formulates the matrices according to chemical requirements to protect its composites against aggressive atmospheres or liquids. These COMPOSITES are ceramic matrix composites. COMPOSIT-C is a PAN carbon fibre reinforced preceramic that is developed to substitute carbon products.

The advantages of COMPOSIT-C are multiple:

- Weight reduction 5 times comparing to steel,
- COMPOSIT-C products can be manufactured within 1 week, much faster than CCC products with at minimum 2month,
- Energy investment is reduced to the minimum, because of the lower temperature manufacturing Process
- Faster individual moulding and shaping,
- Matrix reduction at 1000°C in Vacuum lower than 4 %,
- Matrix reduction at 2400°C in Vacuum lower than 1 5%.

Innovation features and advantages

- Lightweight materials with outstanding mechanical and thermal qualities.
- Ultriaviolet and microwave resistant materials with insulating qualities or electrical conductivity.
- Integral parts can be manufactured much faster than carbon fiber reinforced carbon materials or ceramic matrix composites.
- Lower energy investment for manufacturing of such products.
- More flexibility for moulding and shaping of parts.
- Maximum temperature resistance of 3000°C in vacuum or non oxygen applications.

Current and Potential Domains of Application	- Ceramic matrix composites and fibre reinforced preceramics for high temperature applications. High temperature and wear resistant fibre reinforced synthetics and ceramics. - Aerospace, aeronautics & special industries - Furnaces for vacuum processing - Racks and shelves for tool processing and hardening - Profiles, rings and tubes for special process - Heating elements - Plasma processing - Photovoltaic processing - Absorption of high frequency radiation - Protection against damage caused by projectiles, mines and similar - Parts with high electrical conductivity - Insulating parts.
Type of partner sought	Manufacturing of panels, moulded parts and tubes out of fibre reinforced preceramics to substitute carbon fibre reinforced carbon products. The donor company is mainly interested in research or development contract contracts and selling of components, services, and products.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Composite materials, Materials processing technology

Technology Offer Reference: **RTD_NL_010438**

Cesic : Carbon-Fibre Reinforced Silicon Carbide – Light-Weight Mirror Technology

Technology description	Cesic® is a versatile material that distinguishes itself by the following characteristics: Low specific weight, high stability and stiffness, excellent fracture toughness, low CTE from room to cryo temperatures and quick, cost-effective and near-net-shape manufacturing. These properties make Cesic® an ideal material for high performance applications.
Innovation features and advantages	Cesic® is a ceramic matrix composite. It is characterized by high stiffness and mechanical strength, high thermal conductivity, low coefficient of thermal expansion, and quick, relatively inexpensive manufacturing times. These characteristics make Cesic® an ideal material at reasonable cost for large high-precision space optical and structural applications.
Current and Potential Domains of Application	The starting material in the manufacturing of Cesic® is a short, chopped, randomly oriented carbon fiber material, consisting of both pitch-based and other fibers. The fibers are mixed with a phenolic resin and molded into a blank, which then is heat-treated under vacuum. The result is a light-weight, porous, relatively brittle C/C greenbody. At the present time circular blanks are available in sizes up to 1.6 m, with a thickness up to 200 mm. In the near future greenbody blocks up to 2 m in size or even larger will become available as circular or square blocks. A CNC controlled milling machine of 2.5 m x 1.75 m allows manufacture large, light-weighted, monolithic structures, such as mirrors and components for optical benches. In the manufacture of optical mirrors, curved face sheets (including off-axis designs) can be machined with

reinforcing ribs as thin as 1 mm and of any geometry, including ribs with light-weighting holes or of T-shape for increased stiffness. Upon ma-chining, the greenbody is infiltrated under vacuum conditions with liquid silicon at temperatures above 1600 °C. Capillary forces wick the silicon throughout the porous greenbody, where it reacts with the carbon matrix and the surfaces of the carbon fibers to form carbon-fiber reinforced SiC - Cesic®. The density of the infiltrated Cesic® composite is between 2.70 and 2.98 g/cm3 depending on the material type. EDM ma- chining is possible because of Cesic®'s good electrical conductivity. This machining method is fast compared to grinding, relatively inexpensive and it yields a surface and location accuracy of about 10 µm tolerance over a large area. The maximum size of Cesic® components is only limited by the size of the Si-infiltration furnaces, currently with a useable diameter of 2.4 m with up to three levels, each of height 1.2 m.

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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Microbial infections, Measurement, Treatment

Technology Offer Reference: **RTD_NL_000039**

Ascertaining surface hygiene: fast and easy

Technology description

The prevention of microbial infections is becoming increasingly important in our daily lives. Microorganisms that are present in water, food and surfaces form a major source of infection so it is vital that these organisms are reliably and quickly ascertained to prevent and combat infection. Like Legionella bacteria checks, the much feared MRSA hospital bacteria or the hazards of SARS and bird flu. To be able establish microbial safety on site you need automated and miniaturised detection and monitoring tools. These have been developed on the basis of microtechnology to sample and analyse surface and water specimens. The technology entails isolating (with a few minutes) the genetic material (DNA) of pathogenic microorganisms like bacteria, fungus and yeast. On the basis of this material the type of microorganism present, and the amount, can be established within a few hours.

Innovation features and advantages

The technology enables on-site sampling (also for non-specialists) using a very compact device. Genetic material will be isolated from the samples automatically on the spot. This material will then be ready for further molecular analyses to ascertain the presence of pathogenic microorganisms. The genetic material can also be used, for example, to establish the presence of persons at the scene of a crime.

Current and Potential Domains of Application

- Hospitals and recreational water management
- Dr Food industry
- Forensic research
- Industries that reuse process and cooling water

	The technology has potential for all market segments where it is important to quickly ascertain microbial safety and hygiene, especially where rapid on-site measurement of microbial safety can reduce human risks. The technology may also appeal to market segments where rapid measuring of microorganisms can enable regulation of processes and thus limit economic losses.
Type of partner sought	We are looking for commercial parties in the stated application areas that see the added value of the development so that we can partner them in dealing with their specific issues.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Ceramic, Materials and Powders, Coatings

Technology Offer Reference: **RTD_NL_020940**

Silicon Carbide (SiC) deposition by PECVD technique

Technology description

An Italian Institution is offering an innovative process that allows, through PECVD technique (Plasma Enhanced Chemical Vapour Deposition) coating with Silicon Carbide (SiC) the substrates of any material at low temperatures (~200°C). SiC is a high tech ceramic material originally developed for space structures. It has outstanding physical properties as it is light, stiff, resistant and very hard. It has very high thermal conductivity and can be used for regenerative medicine applications.

The Silicon Carbide (SiC) is a ceramic high tech material having outstanding physical properties: it is light, stiff, resistant and very hard. It has very high thermal conductivity, similar to that of a metal. The classical production of this material foresees the use of a furnace where the reactive materials are heated up to 1200 °C. This technique is very ex pensive and the high temperature limits its deposition on substrates able to withstand high thermal loads. Instead, by means of the PECVD technique (Plasma Enhanced Chemical Vapour Deposition) it is possible to coat with SiC the substrates at low temperatures (200 °C). The low temperature of the process permits the use of a range of substrate materials not possible with the previous technique (for example also plastics) and avoids the high deposition costs typical of the high temperature process.

The process foresees the use of a vacuum chamber having an internal Radio Frequency (RF) emitter. The optical component to be coated is placed in contact with an electrode and a gas diffusion system placed in front of the surface or optic to be coated guarantees the flux of the precursor chemicals necessary for the deposition. Plasma is generated by means of the RF emitter that makes the chemical reactions responsible for the coating deposition possible.

Innovation features and advantages

The SiC-PECVD process is surely competitive with respect to the high temperature alternative, namely the SiC-CVD (Chemical Vapour Deposition). This needs a temperature of 1200 °C. On the contrary, the SiC-PECVD can be deposited at 150-200 °C permitting the deposition of coatings onto a large number of materials, plastic included. The low temperature permits an overall cheaper cost. This kind of SiC can be optically super polished to very low levels, 5 Angstrom or less, exactly like SiC-CVD.
The thermostructural characteristics of SiC are extremely interesting when high resistance to thermal stresses and good thermal conductivity are necessary. Furthermore, its hardness and biocompatibility makes it essential for applications in Orthopaedia and prosthesis. The cheaper and simpler PECVD technique has the potential to open new fields of application of this material.

Current and Potential Domains of Application

This technique has been studied for applications related to the optics of ground and space telescopes. The space applications span from optics for global monitoring, environment, security and weather forecast, and include optics for astronomical space telescopes. Ground applications can include X-ray optics for synchrotron and the manufacturing of UV (Ultra-Violet) collectors for nanolithography. In the future the integrated circuits will have thinner strips than today and will be manufactured using UV light @13.5 nm. This light will be generated by means of plasma and collected by special optics (collectors) that are placed near the plasma itself. The heavy thermal load makes it difficult to produce suitable collectors. The SiC-PECVD is a material that reflects very well UV light and can withstand high temperatures. The creation of SiC collectors is hence an interesting option that could satisfy the needs of the collectors for the microelectronics industry.

In Orthopaedia the need to have prosthesis with long operative life is necessary, reducing the need to replace the implant after 10-15 years. The coating of the prosthesis with a hard and biocompatible material like SiC has the potential of satisfying such requirement. With this respect, the relatively cheaper SiC-PECVD is well suited for the use as hard coating for orthopaedic prosthesis, reducing the wear and hence the need to replace the implant after a few years of use.

	In addition to the well known biocompatibility of SiC, also new data showing that mesenchymal stem cells, isolated from adipose tissue, adhere to the SiC-PECVD material and differentiate towards cells of the osteogenic lineage (Osteoblasts)1, open the perspective to use this material as a suitable scaffold for either somatic or stem cells in regenerative medicine by tissue engineering approach.
Type of partner sought	The technology owner is looking for partners for a license agreement.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Coatings, Materials processing technology

Technology Offer Reference: **RTD_NL_020741**

SL-MMC – Self Lubricating Metal Matrix Composite for bearings and electrical slip-rings

Technology description

Lubrication of ball bearings or plain bearings may be done by fluid (grease) or by solid lubricants (like graphite or MoS2). Especially for dry environments or vacuum/space, only MoS2 is of interest. This can be applied as coatings or as particles inside of composite materials. There are some commercial products based on polymer matrix with embedded MoS2-particles. However, their use as cages in ball bearings is limited by temperature. The novel SL-MMC offers a metal matrix which overcomes these drawbacks. The technology provider was leading in the development of a very specialized process and cages or bushes can now be offered.

The SL-MMC-process is based on powder metallurgy, but its speciality enables the combination of MoS2 inside a copper matrix and also to achieve high filler contents (up to 60 volume%). Based on that, the selection of fillers (MoS2) can be done based on the need of application under vacuum, but can also be combined with others for functionality in humid air.

During the GSTP project a wide range of material data was derived. These showed that mechanical properties are better than those of conventional powder metallurgic Cu-MMCs. Thermal expansion is close to that of steel, which makes design of bearings for use in a wide temperature range easier (no thermal mismatch). The friction coefficient on material level for a proper combination of fillers, was found in humid air with ~0,2, under vacuum friction rises from ~0,05 (RT) to ~0,1 (300°C). Ball bearing tests up to 250.000 revolutions done by an independent test house showed a proper solid lubrication and low torque (0,002Nm) at 300°C under vacuum. Also in bush test for more than

	200.000 revolutions, torque was in range of 0,12Nm. As third application the functionality as electrical slip-ring was evaluated. Hence, basic functionality of this material up to 300°c under vacuum is shown
Innovation features and advantages	The main advantage of this SL-MMC is the lubrication efficiency under high temperature in vacuum or dry environment like inert gases. It combines the advantages of a metal (high thermal conductance, thermal expansion in the range of steel, radiation insensitive) with the solid lubrication of MoS2 being able to lubricate in dry environment/vacuum and temperature up to more than 300°C. Ball Bearings with CuMMC cage passed all tribology and application tests at 300°C
Current and Potential Domains of Application	The material is suitable for any kind of roller bearing, plain bearings or electrical slip-rings. However, it is a high class material, i.e. the best cost benefit is achieved in high temperature applications up to 300°C evaluated, up to 400°C envisaged, in dry environment. There are no alternatives commercially available (too high temperature for polymers and fluid lubricants, and too low for real high temperature friction materials like ceramics). Thus it might be unique to be used in dry environment in cases where grease replacement of lubrication is targeted, e.g. in aeronautic applications, like turbines and air-bleed systems and even in vacuum devices.
Type of partner sought	The company is interested in cooperation and offers production facilities and testing (mechanical and application).
Additional Comments	Semi-finished parts (rods) are available for demonstration.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Building materials

Technology Offer Reference: **RTD_NL_010142**

Radiation shielding using micro cavities filled with highly pressurized gas

Technology description

The technology provider has done extensive research for ESA in storing hydrogen and helium in hollow glass microspheres, leading to a new concept for a radiation shielding material. Due to the fact that the material can be easily adapted to any given form, it not only perfectly suits the demands of satellites, but can be utilized in a variety of terrestrial applications. The emphasis within this technology offer is on compact, cheap, flexible next generation radiation shielding materials for several applications (space and terrestrial).

Usually, hydrogen is stored under high pressure, in chemical compounds or in its liquid state requiring very low temperatures. Gaseous hydrogen can be stored in hollow glass microspheres (5 – 200 µm-diameters) under high pressure (350 – 700 bar). The sphere-wall is impermeable for hydrogen at ambient temperature; the heating of the spheres increases the diffusion of hydrogen through the wall. The technology provider developed an innovative process for ESA to fill and release hydrogen and helium into the spheres. First analysis shows that such a system can reach hydrogen storage capacities of up to 10 wt% in theory. This value depends on the sphere dimensions, the weight of the spheres and the hydrogen pressure. The expertise gained in the course of the extensive research on gas storage in microspheres lead to new applications for such a system. One of these applications is the use of microspheres filled with highly pressurized gas as radiation shielding material. The considered material is easy to handle with respect to safety and flexibility.

First preliminary tests were done to proof the concept of a shielding material based on microspheres. The sample plates were placed between a neutron beam source and a scintillator. The first measurements were done for hollow microspheres filled with 50 bar and

80 bar of hydrogen. As a reference sample the neutron radiography image of the empty hollow micro glass spheres were measured. The transmission measurements were continued every day to observe the hydrogen content in the micro spheres. As can be seen, the higher the pressure inside the microspheres the higher the neutron absorption rate. The technology provider has the know-how to produce gas filled and modified microspheres and to test them under relevant conditions.

Innovation features and advantages

Since hydrogen is very effective in absorbing the energy of highly energetic particles with minimal generation of secondary particles, it is particularly suitable for radiation shielding. Effective radiation shielding materials therefore often incorporate high concentrations of hydrogen. By using microspheres, it becomes possible to collect large amounts of hydrogen atoms with a relatively high gravimetric as well as volumetric density. It is also possible to store other light gases in the microspheres like Deuterium or Helium, in order to customize the absorption properties of the material. Preliminary calculations show that this technique can be used as radiation shielding with significant mass savings in respect to conventional materials. In comparison to Aluminum for example, the hydrogen filled microspheres can shield high energy protons and ions with 30% to 40% increased efficiency. Also bremsstrahlung, secondary neutrons and gamma rays can be significantly reduced. Another important part of the system is the modification of microspheres in different ways. All parameters and modifications have an impact on their specific radiation shielding properties. The technology provider has developed a new unique technology to coat the microspheres with different materials to improve the thermal and mechanical properties. Microspheres are cheap and can be easily filled with different gases. The combination of composites and microspheres could lead to a flexible multifunctional layer as radiation shielding material with higher efficiencies than current state-of-the-art materials like Aluminum, Kevlar or Aerogel.

Current and Potential Domains of Application

Due to the fact that the material can be easily adapted to any given form, it not only perfectly suits the demands of satellites, but can be utilized in a variety of terrestrial applications such as radiation shielding of aircrafts, shielding of computer and electronics, radiation shielding in research facilities as well as on medical sites, but also protective clothing for PCRs (Competent Person in Radioprotection).

Additional Comments	The innovation currently undergoes further development and comprises both a patent (granted) and secret know-how.

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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Materials processing technology

Technology Offer Reference: **RTD_NL_010743**

Nanotechnology and Resin Transfer Molding (RTM)

Technology description

Resin Transfer Molding is a technological process useful to manufacture composite structures with different 3D complex shape, dimension and mechanical characteristics. The proposing company, with strong experience in the aerospace field, offers significant improvements to the characteristic of the materials with nanofiller dispersion into the resin in order to tailor the specific characteristics of the material and fit them to specific needs.

In the Resin Transfer Molding process two chemical components (resin and curing agent) are mixed and injected in a closed mould containing a fiber dry preform. The mixing of the resin and curing agent is a critical phase of the process; it is possible to perform this operation with static or dynamic methods.

The static method is characterized by a mixing chamber in which resin and curing agent are mixed in stoichiometric proportion. The mixture is then injected into the mould using suitable injection pipes. After the injection, a cleaning step (defined as a refreshing phase) is needed to avoid process degradation. Inst characterized by a continuous circulation of the base materials (resin and curing agent) in a circuit; the final mixing is the last phase just before the injection into the mold. In this case, the cleaning procedure does not represent a critical step for the RTM system safety.

RTM is an ideal solution for the manufacturing of composite products in many industries and categories as automotive and trucking industry, aircraft and aeronautics industry, marine and watercraft industry, public transportation, medical, building industry.

In fact, by this method it is possible to produce high quality items with a significant cost and time reduction. Using dedicated software (ex. PAM RTM, Mould flow) it is possible, by numerical/FEM simulation, to determine and optimize the RTM process parameters: injection pressure and temperature, gate and vent position in the mould, resin flows, curing cycle, internal voids/cavity and porosity, resin over packing and/or poor region in the perform, welds and meld line, final curing degree.

In summarizing the value of RTM composites for aerospace applications, there are several key physical attributes that continue to drive the development of new generations of these materials. Improved fuel economy, payload capacity, higher transport performance and pollution reduction that is driving the push to lighter weight innovative materials. The demand for higher performance composite materials opens the door for these materials to replace metal for weight savings as well as facilitating part consolidations. Furthermore the advancements of nanocomposite systems also open the door to replace other engineering thermoplastics (ETP's) for improved processing as well as the overall recyclability. Furthermore, increasing design requirements continue to push for materials with dimensional stability.

In particular, for space transportation needs, mass budget is definitely the most important issue. In this regard the implementation in launchers and payloads of novel materials allowing a significant mass saving and is considered highly eligible for upper stages and payloads (i.e. satellites or space exploration vehicles). Image: RT

Innovation features and advantages

The main innovation aspects of RTM respect to other technologies are listed in the following:
Design Flexibility: the material selection is made complex by the multiplicity of possible resin / fiber combinations. With RTM, however, the designer has the flexibility of tailoring the materials more closely to the applied loading system (specific strength) and fabricate shapes which are difficult, if not impossible, to form using more conventional methods.

Incorporation of materials. RTM allows the molder to easily incorporate core materials for strength and weight savings, complicated inserts, bosses, ribs, undercuts, etc.

Improvement of surface finish. Both sides of RTM-made components

will have high quality finished surfaces. This aspect gives high added value to the final product because it reduces the necessity of finishing operations.

Faster Production. Depending on such factors as resin reactivity, heated vs. unheated tools, part size, etc., RTM-made parts can be produced at the rate of 5-20 times faster than conventional techniques.

Labor Savings. Labor/part cost with RTM is significantly lower than other FRP manufacturing processes. The exception is compression molding but much lower capital cost (up to 90% lower) make RTM more attractive unless volumes of 50,000+ parts are required. Furthermore, RTM does not require skilled operators such as with hand lay-up or spray-up.

Dimensional Tolerances. RTM parts can be designed around very tight tolerances (i.e. +0.005") in the X, Y and Z product planes.

Part Reproducibility. Controlled tolerances provide for excellent reproducibility on a part to part basis. This permits very accurate cost estimating and tight cost control.

Low Material Wastage. As little as 2-3% wastage rates are readily achievable. Proper mold design, tight product pinch-offs less preforms and accurate, controllable injection equipment assist greatly in keeping waste to a minimum.

Filler Additives. Given the relatively low viscosity of injection quality resins, very high filler loadings can be realized. The addition of fillers to resin will produce properties such as enhanced fire resistance, lower exothermal, less shrinkage and, above all, lower materials cost considerably.

Higher Volume Fractions (percentage of a mold cavity taken up by the reinforcement). While most industrial moldings typically have a volume fraction in the range of 15-20%, RTM will allow the molder to achieve volume fractions as high as 65%. The higher the volume fraction, the greater the strength of the finished part.

Environmental Compliance. Because the process involves the use of closed molds, styrene monomer emissions are kept to an absolute

minimum. Without ventilation of any kind, the RTM process produces less than 10% of the emissions of hand lay-up and spray-up. RTM will fall well within any minimum standards for emission currently in place or under consideration by regulatory authorities.

Current and Potential Domains of Application

RTM is an ideal solution for the manufacturing of composite products in many industries and categories such as:

- automotive and trucking industry.
- marine and watercraft industry
- public transportation
- medical and building industry
- energy

In terms of specific product different equipment can be easily produced with this technology:

- Auto body panels
- Truck air deflectors
- Wind blades
- Chemical storage tanks
- Solar collectors
- RV components
- Propellers
- Bathtub/shower units
- Antenna dishes
- Chairs
- Swim pool panels
- Boat hulls
- Aircraft radar
- Helmet

The versatility of RTM technology is due to the possibility of tailoring the specific characteristic of the material. This can be done in two principal ways:

1. Selecting the resin (epoxy, polyester, ecc)/fiber (carbon, glass, kevlar) combination and the optimum number of fiber layers of the initial lay-up. It is also possible to manufacture sandwich material and this can be advantageous because it is possible to obtain the combination of composite face sheets and a foam core yields to a lightweight structure with high strength and flexural stiffness that is resistant to corrosion and moisture. For example syntactic and PIM foams have gained considerable importance as core materials in sandwich composites for a

variety of application due to their high compressive strength, damage tolerance and low moisture absorption. Using RTM, sandwich structures can be fabricated in a one step process that is not limited in shape or size. Furthermore removing the complicated process of bonding the face sheets to the core enhances the viability of sandwich structures.

2. Improve the characteristic of the material with nanofiller dispersion into the resin in order to tailor the specific characteristics of the material and fit them to specific needs. In this way it's possible to improve mechanical properties such as stiffness (for what concern structural components), or for example improve electrical conductivity (antenna reflector production). In addition, various other additives can be used to modify the performance in terms of impact resistance, magnetic properties, reflectivity, etc. of a polymer.

Depending on the selected nanoparticle, nanomaterials can improve the following functions of the material structures:

- Mechanical: strength, tenacity, crack propagation, hardness
- Electrical conductivity: ESD or EMI properties
- Thermal: thermal protection and improvement of thermal conductivity.

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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Sol-gel technology, Nanomaterials

Technology Offer Reference: **RTD_NL_010044**

SILICA-BASED AEROGEL

Technology description

Active Aerogels is a Portuguese private owned company that produces and commercializes aerogels for several applications in space, oil & gas, aeronautics, building and wastewater treatment. Aerogel is a solid with unusual properties, such as ultra-light and very low thermal conductivity due to its high porosity. Aerogels can resist large temperature ranges (-180 ºC to 350 ºC), vibration and high vacuum and may be supplied in blocks, blankets or powder. Active Aerogels provides solutions for highly demanding thermal requirements and is namely looking to test new applications or to adapt aerogels to specific needs.

Aerogels are prepared by sol-gel technology which the most known bottom-up approaches to prepare nanomaterials. Sol-gel technology allows preparing materials in different shapes from fibres, powders, and monoliths. Particularly, the silica based aerogels monoliths offered by our team are extremely flexible as shown in figure 1. The thermal conductivity of our aerogel is 39 mW m-1 K-1 and since this material does not have the glass transition temperature it can be applicable between -180 oC to 350 oC without any changes in its properties. Additionally, this aerogel is highly hydrophobic avoiding its degradation in contact with humid environments. This material can be applied for general thermal insulation, namely in space environments, buildings and pipelines. On the other hand, due to its high specific surface area they can be used as adsorbents for wastewater, oil, and others.

Active Aerogels is working on the aerogels development since 2005 mainly for space application such as Mars Rovers insulation. At moment, due to the product maturity we are going into other markets such as buildings and pipeline insulation.

Innovation features and advantages	Our aerogel combines low density, low thermal conductivity, hydrophobicity, flexibility and is suitable for temperatures from -180 to 350 oC. The handling during installation does not cause skin irritation. Silica based aerogel – Physical properties - Density: 80–150 kg m-3 - Thermal conductivity: 32 – 40 mW m-1 K-1 (SATP), 24 mW m-1 K-1 (10 mbar, RT); - Operation temperature: -180 to 350 oC; - Highly Hydrophobic; - Extremely flexible; Available in monoliths, blanket and powder.
Current and Potential Domains of Application	In space the aerogel can be used for thermal insulation on satellites, landers, rovers and launchers. In Oil & Gas the aerogels can be used for pipeline's thermal insulator. Aerogel can be used for pollutants adsorption namely wastewater and oil spill. In aeronautics, the aerogel play an important role for its low density with outstanding thermal insulation performance. Although knowing the high cost of aerogel for buildings it will become a potential solution in order to comply with new EU regulations on energy efficiency for buildings.

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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Insulation material, Aerogel

Technology Offer Reference: **RTD_NL_010045**

High performing and cost effective insulation material

Technology description

The small Swedish company Svenska Aerogel offers the material Quartzene, an aerogel like material with excellent insulation properties at a low price.
The manufacturing process of Quartzene is estimated to cut production costs by approximately 90 % compared to traditional methods of producing aerogels. Quartzene is totally environmentally friendly.
Quartzene is available for demonstration and has a great potential not only as insulation material, but also as additive and for filtration and dehumidification.
Svenska Aerogel is looking for producers that can use this fine nanoporous material to enhance different physical properties of their existing or new products.
The first Aerogel was manufactured in 1931 by an American scientist. It is made by mixing chemicals and making them form a gel. The liquid component is removed from this gel and replaced with a gas leaving a porous solid structure which is the aerogel.
So far the main problem with classical aerogels has been the complicated and energy inefficient production method which for a long time has limited their use to high tech price insensitive markets such as the space industry.
Svenska Aerogel AB's unique production method makes it possible to reduce the production cost and offer its material Quartzene, with physical properties similar to aerogels, at a much lower price. This makes the material Quartzene unique compared to conventional aerogels.
Aerogels are very good thermal insulators, because they very nearly eliminate the three methods of heat transfer; convection, conduction and radiation. This makes aerogels the world's best known insulation material in existence today with thermal conductivity normally between 10-19 mW/m,K, this is about 2 to 4 times better than the conventional materials

used today.
Svenska Aerogel can optimize the functionality of Quartzene due to its flexible production method. Our production method gives us opportunities to incorporate or dope different chemicals into the Quartzene as well as to customize different physical properties such as the internal surface, density and porous structure.

Innovation features and advantages

Svenska Aerogel offers an energy- and cost-efficient production process of Quartzene, estimated to cut production costs by approximately 90 % compared to traditional methods of producing aerogels. This enables the use of the aerogels' unique physical properties in common mass market products.

Further Information:
- High porosity and large specific surface
- Does not burn
- Low density
- Environmentally harmless and recyclable
- Made from sustainable raw materials
- Adaptable to capture virtually all types of pollutants
- High insulating capacity
- Low production cost

Current and Potential Domains of Application

- Insulation materials for building and industrial applications
- Additives in paints and coatings
- Additives in gypsum and concrete
- Additives in health care and cosmetics
- Molecular filtration
- Dehumidification

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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Coatings

Technology Offer Reference: **RTD_NL_010946**

Ultra Low Friction Films of MoS2

Technology description

An ultra-low friction film is one that provides a friction coefficient that is equal to or lower than 0.01 in pure sliding. This is typically a factor of 10-50 lower than conventional surfaces. Such low friction coefficients can be achieved using Molybdenum Disulphide (MoS2) films, when applied correctly and under the correct conditions.

Thin films of Molybdenum Disulphide (MoS2) can exhibit ultra low friction performance when formed by sputtering. However, the components need to operate under vacuum conditions in order to limit oxidation which would considerably affect their performance.

Through extensive research and development the limitations of the standard methods for applying films of MoS2 have been examined.

Burnished films often suffer from low adhesion and non-uniform thickness which is completely unacceptable for precision components. Whilst their friction may be low, their lifetime is short and unpredictable.

Bonded films can provide the durability required but the friction coefficient is an order of magnitude higher at 0.1. These films are completely reliant on the binder for adhesion and so are generally thicker, meaning that they are unsuitable for precision applications without subjecting them to complex running-in cycles to remove the excess lubricant. Other aspects that need to be critically monitored are the surface preparation and the binder/solvent chemistry.

Unlike the aforementioned techniques, sputter deposited MoS2 can be applied with sub-micron accuracy so that it does not compromise the engineering tolerances required by high precision components such as

ball bearings.

The techniques of sputtering allow for sub-micron thin films of MoS2, with its intrinsic low shear strength, to be adherently deposited on surfaces. Under vacuum conditions such films provide ultra low friction.

For general bearing applications, the MoS2 is applied by the physical vapour deposition technique of high rate magnetron sputtering.

Innovation features and advantages

The principal advantages of sputtering MoS2:

Ultra low friction capabilities in vacuum and inert environments.

Large temperature range of operation, from cryogenic to 800oC.

Long endurance under pure sliding motion.

Ability to uniformly coat complex surfaces.

Synergistic effects with PTFE based cages in rolling element bearings.

However there are some limitations of such films:

The ultra low friction properties are not achieved under conditions of low stress or sliding speeds.

Its friction temporarily increases after long dwell periods in vacuum.

Its friction increases in humid air.

The lubricant has a finite lifetime, although this can be in excess of 15 years, depending on the application.

Current and Potential Domains of Application

This technology has been used for bearing systems on-board spacecrafts and satellites. Over 120 flight systems have been supplied and there have never been any failures to date, with some having been in space for 15 years.

Other areas of application include:

- Precision medical equipment
- Semiconductor manufacturing
- Cryogenic gearbox
- Extreme temperature applications

Additional Comments	The company provides a novel method of applying the MoS2 coating, as opposed to a novel coating itself. However, this method allows for thinner and more consistent coating layer than other techniques available.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Materials Processing Technology, Materials testing, Chemical, Industrial machinery/processes

Technology Offer Reference: **RTD_NL_010747**

Method and means for connecting thin metal layers

Technology description

The European Space Agency is offering an innovative method for bonding two thin metal layers applied to flexible substrates. This connection is achieved by micro (hollow) rivets, providing a mechanical and electrical link through the use of modern laser technology. This method is reliable and doesn't require large contact areas, effortlessly providing a mechanical and electrical bond. License agreement is sought.

Protected in this patent is a method to mechanically and electrically connect two thin metal layers. Specifically, this method is suitable for thin layers mounted on flexible substrates and was originally developed for the bonding of thin solar cells and flexible, film-reinforced contact strips.

Nowadays there is a big research effort going into solar cell technologies, embedded in the push for greener energy sources, as well as energy generation in remote areas, such as with spacecrafts. Thin-film solar cells are among the technologies being developed, and when combined with flexible substrates and circuit boards, the very interesting concept of flexible solar cells comes to mind. These have several advantages over rigid products, namely in their installation and eventual portability, however, present some technical challenges.

Understandably, a flexible solar cell would require an also flexible and consequently thin electrical conductor to deliver the produced energy to the end consumer. These requirement for the electrical wiring make traditional bonding techniques obsolete, as soldering and the use of contact adhesives require high contact areas or that the substrate presents sufficient mechanical rigidity to resist the high pressures on the surfaces during the bonding. The thermal resistance of the materials

involved must also be taken into account, as soldering requires high temperatures that may be incompatible with flexible substrates.

Current laser technologies include the connection of metal parts through irradiation, soldering without any additional materials by melting and mixing the materials involved. It is with the application of pulse laser radiation that the inventor sought to overcome previous hurdles. The protected process enables the micro riveting of thin layers and films, therefore enabling the mechanic and electrical connection of the materials involved. This method is suitable for flexible substrates, requiring little space and avoiding the requirements for special and complex materials and surfaces.

The hollow riveting process is preceded by some surface treatment steps, namely the removing of extra layers above the thin-film that is to be bonded. These are also laser based, a positive feature, since it eschews the need for different machinery and setups for the connection procedure. The strength of the bond can be easily controlled through the number of rivets, as the process allows the simultaneous multiple riveting.

Innovation features and advantages	This invention provides a clear advantage over prior art, solving a bonding issue on thin-film solar cells mounted on flexible substrates. Although this was its envisioned application when being developed, this technology is applicable to a much broader spectrum of fields of expertise. By providing a solid, robust, simple and relatively small attachment method, hollow riveting removes the need for high technical, procedural and technological efforts, special materials or surfaces when considering the bonding of two metal films.
Current and Potential Domains of Application	Any industry dealing with thin-films of metals that require the bonding of said materials would be highly benefited by the knowledge contain in this patent. For example purposes the flexible solar cell market is mentioned, but the applicability of the invention is not restricted to this.
Intellectual Property Rights	Patent(s) applied for but not yet granted.

Type of partner sought	Type of partner sought : Industry - Specific area of activity of the partner : Energy - Task to be performed by the partner sought : Industrialization of the invention through manufacturing under license.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Non-ferrous Metals and Alloys, Medical/health, Aeronautic/Aerospace.

Technology Offer Reference: **RTD_NL_111648**

Method and apparatus for combinatorial alloy discovery and development using high energy electron beams.

Technology description

The European Space Agency (ESA) is interested in licensing a system and method for the synthesis of combinatorial alloy libraries. This process describes a high throughput screening technique for the materials engineering field, allowing the preparation and analysis of several different alloys in a single run. This is achieved through the use of a high energy electron beam to melt, mix and control the cooling of two or more elements. The beam and specimen characteristics define the composition of the alloy. License agreement is sought.

Akin to the revolution in biochemistry due to the introduction of high throughput screening techniques, combinatorial methods can greatly accelerate the discovery and development of materials whose properties cannot be readily predicted from their composition and processing history. These systems are based on the rapid processing of samples to generate a high volume of test subjects and subsequent testing. Often these processes are fully automatic, with little user interaction from the generation of the samples library to the screening for the compound with desirable properties.

The translation of these techniques into the material sciences field of expertise is hindered by some particular challenges, as the requirement for an extremely clean environment while exposing the samples to extremely high temperatures. Also, alloys must be guaranteed to be homogeneous in order to accurately portray that mixture's mechanical properties.

High energy electron beams are currently used in several metallurgical processes as localized and highly controllable heat sources. They are

	considered superior to laser sources in the transfer of incident energy into a given volume and are capable of rapidly deliver enough energy to melt or vaporize the alloy components, with the precise volume melted or vaporized depending on the beam and materials characteristics, and thus being a controllable variable. The present invention overcomes the limitations of the prior art by employing a maneuverable high energy electron beam to rapidly synthesize libraries of alloy samples having well-defined bulk-like compositions that are suitable for rapid screening. The invention covers the procedure and the device itself, with its varied embodiments covering several protocols to determine the alloy percentage compositions through the fine tuning of the energy system or the substrate configuration prior to the melting process.
Innovation features and advantages	Through the original application of an established technique in the metallurgical field to a promising concept, the inventor was capable of revolutionizing the combinatorial method approach for material sciences, opening up the immense potential of high throughput screening of alloys. The method and device provided are capable of producing a library of test alloy samples and screen those for selected properties quickly and in a cost effective way.
Current and Potential Domains of Application	The main domain would be the metallurgical industry, however, the developed alloys could be used anywhere else, and as such this invention has the potential to bring benefits for several other fields of application. As such, this could be an improvement for any technology or product that could benefit from an alloy with optimized properties. As an example, the aerospace industry.
Intellectual Property Rights	Patent(s) applied for but not yet granted.

Type of partner sought	Any industry that works with metal alloys could benefit from the ease of access to these materials. Along with the tools to properly produce such alloys, this technology also does so in a cost effective way.
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INTERNATIONAL European Space Agency (ESA)

Research organization

Keywords

Materials Processing Technology, Non-ferrous Metals and Alloys, Medical/health, Automotive, Aeronautic/Aerospace.

Technology Offer Reference: **RTD_NL_010749**

Method and system for production and additive manufacturing of metals and alloys

Technology description

The European Space Agency (ESA) is interested in licensing a method and system are for depositing metals and alloys by decomposing one or more metal iodides using a directed plasma arc source. As additive manufacturing approach for the fabrication of shaped components may be accomplished by directing the source output towards defined regions of a work-piece. License agreement is sought.

Some metals are highly valued for their intrinsic properties but their production is very costly due to their high affinity for oxygen at elevated temperatures. For such materials, conventional metallurgical processes are not suitable. Titanium (Ti), zirconium (Zr) and beryllium (Be) alloys are good examples of strategically important materials that suffer from the aforementioned limitation.

The search for technologies that can deliver a cheaper product by using less expensive raw materials or reducing the number, duration or cost of the intermediate steps is ongoing. Some more savings can be obtained by adopting techniques that require less material, such as additive manufacturing.

In this invention, the limitations from prior art are surpassed through the use of metal iodides in a directed plasma system to enable the bulk production of the powder form of the desired alloys. This powder is suitable for use in additive manufacturing techniques, which are more raw resource efficient than traditional machining procedures. Metal iodides are quite inexpensive nowadays because they can be formed by reacting metal chloride and hydrogen iodide.

Innovation features and advantages	By providing an inexpensive way to produce metal powders out of materials that have high affinity for oxygen, this invention allows the application of state of the art techniques, such as additive manufacturing to previously costprohibitive alloys. In the end, the cost savings associated with this technology could revolutionize the general public access to these highly sought-after materials, with their excellent properties providing benefits for several science and application fields.
Current and Potential Domains of Application	The main domain would be the metallurgical industry, however, the developed alloys could be used anywhere else, and as such this invention has the potential to bring benefits for several other fields of application.
Intellectual Property Rights	Patent(s) applied for but not yet granted.
Type of partner sought	Any industry that works with metal alloys could benefit from the ease of access to these materials. Along with the tools to properly produce such alloys, this technology also does so in a cost effective way.
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INTERNATIONAL

European Synchrotron Radiation Facility (ESRF)

Research organisation

Keywords

Coatings, Materials and Powders, Colors and varnish, Composite materials

Know-How Offer Reference: **RTD_FR_110850**

Synchrotron X-ray facilities and scientific support for industrial materials characterization

Technology description

The European Synchrotron Radiation Facility (ESRF) is the most powerful synchrotron radiation source in Europe.

Materials and process characterisation is an essential and crucial step in the search for tomorrow's technologies: ESRF applies synchrotron X-rays for industrial R&D and materials characterisation whenever details materials and structure understanding is required: materials science and nanotechnology, food science., chemistry, engineering and advanced materials, environment and energy, home and personal care, pharmaceuticals, health and life science.

Applications: http://www.esrf.fr/Industry/applications

To open these facilities to the broader field and requirements of industrial users, the ESRF is working with local, CEA and CNRS, and international, ILL, partners under the banner of the Grenoble Innovation for Advanced New Technologies (GIANT).

Innovation features and advantages

Synchrotron X-rays of the ESRF and the neutrons of our sister institute the ILL are particularly powerful for the study of materials in situ and under real conditions of processing and end-use. Sample environments typically available include: furnaces, high pressure, cryostats, tension/stress, chemical reaction and corrosive chemical conditions, intense electrical and magnetic fields, etc.

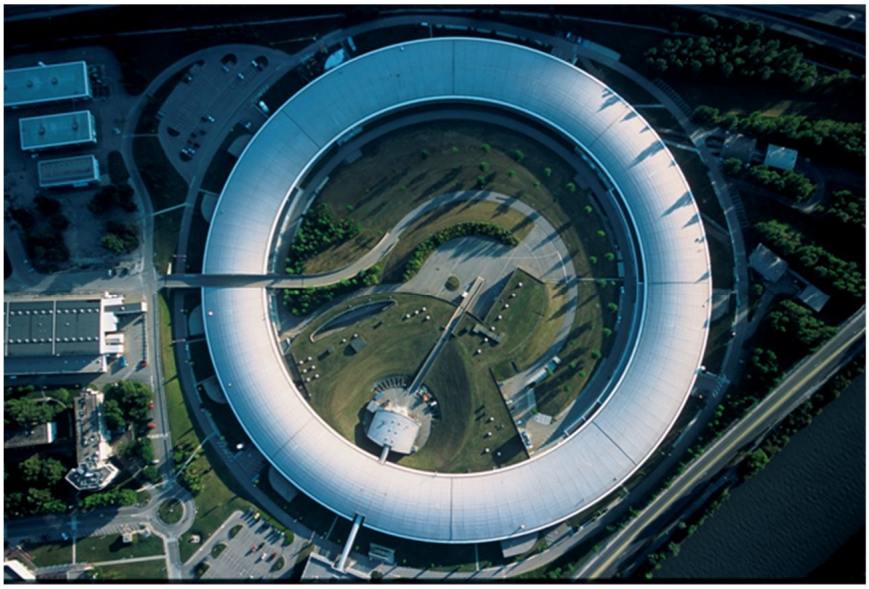
Current and Potential Domains of Application

The world-leading synchrotron X-ray facilities of the ESRF allow the ultimate analysis and characterisation of materials, going far beyond those possible using traditional laboratory techniques. Synchrotron light is a flexible, precise and non-destructive method for learning about the structure and behaviour of materials from the atomic to macroscopic level under in situ manufacturing and end-use conditions. We operate mail-in services for synchrotron CT and tomography, powder diffraction, SAXS, protein crystallography, strain imaging, and EXAFS amongst other techniques.

Competitive access by peer review is encouraged for industry able to publish their results.
The European Synchrotron Radiation Facility (ESRF) is a research institute in the heart of the Alps in Grenoble, providing intense synchrotron light for 6,500 scientists from around the world to carry out both fundamental and applied science, and industrial experiments. Materials and process engineering, health, drug discovery and development, catalysis, food and agriculture, energy are just some of the many fields in which industrial R&D can make excellent use of our facilities.

www.esrf.fr/industry

Picture(s)



Type of partner sought	Our 40 X-ray instruments with technical and scientific support are open for industrial R&D and collaborative innovation: • Fast-track paid-for access and services with full IP retention and confidentiality • Tailored partnerships according to your R&D needs • Funded studentships and apprentices (e.g. CIFRE and ANR projects)
EEN Contact	**CCI de Grenoble** *Elodie WAGNER* elodie.wagner@grenoble.cci.fr +33 4 76 28 28 09

INTERNATIONAL

European Synchrotron Radiation Facility (ESRF)

Research organization

Keywords

Materials Processing Technology, Materials testing, Coatings, Materials for Magnetic Applications, Optical Materials, Properties of Materials, Corrosion/Degradation, Surface analysis, Surface treatments, Superconducting materials, Medical/health, Automotive, Telecommunications, Energy, Industrial machinery/processes, Electronics/Semiconductors.

Know-How Offer
Partner search for European project

Reference: **RTD_FR_110751**

IRT NanoElec – Large-Scale Instruments Characterisation Program

Technology description

IRT NanoElec is one of six institutes nationwide which received funding under the French government's economic stimulus package in the context of "Investissment d'avenir". The institute is today a pillar of Grenoble's renowned research ecosystem, which, thanks to MINATEC, has been Europe's leading high-tech hub since 2005. The institute's next objective is to become one of the world's top-three centers for micro and nanotechnology research. In particular, in this framework, the Large-Scale Instruments Characterisation Program has been funded with 6.5MEuros across the period 2012-2019, in order to open Synchrotron (ESRF) and Neutron (ILL) Large Characterisation facilities to the industry of Micro-Nano Electronics. Industrial partners of this programs are ST Microelectronics and SOITEC.

Innovation features and advantages

The Grenoble large-scale instruments potentially offer an unrivalled performance to achieve advanced micro-nanoelectronics characterisation. However, access to these research infrastructures is adapted to the world of academic research and generally, apart from several exceptions such as structural biology for drug discovery, is not yet optimally aligned to the needs of industrial R&D. Industrial needs are rapid access, confidentiality, strong scientific support from experiment feasibility to running the experiment and data analysis. Important factors for the use of large instruments for industrial innovation and R&D are the prior, but basic, awareness of the power and limits of the infrastructure techniques (for example

	diffraction, scattering, imaging, and spectroscopy; all potentially under in situ or under operando conditions), adapted sample preparation methods, and more generally a precise definition of the relevant experiment or measurement required to meet the industrial technical question.
Current and Potential Domains of Application	Nano and Microelectronics Industry; semiconductor manufacturing; organic electronics; sensor manufacturing; optoelectronic/photovoltaic manufacturing industry.
Type of partner sought	Industries operating in the Nano and Microelectronics sector; academic partners actives in the research on electronics or optoelectronics, molecular electronics, photonics, mechatronic, nanosensors (also bio).
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FRANCE HEF IREIS

Company

Keywords

Building materials, Ceramic Materials and Powders, Composite materials, Materials, Processing Technology, Coatings, Surface treatments

Technology offer Reference: **TO_FR_020952**

Thin film imbedded nanoparticles obtained in large size vacuum deposition systems

Technology description

HEF IREIS is a French Group specialized in surface engineering, and developed thin film using large industrial deposition equipment. IREIS study surface properties and improve them by adding new features and develop industrial solutions.

A recent project was dedicated on a specific sputtering process to produce nanoparticules. Silver nanoparticles have been deposited in between SiOx thin films using sputtering magnetron cathode and RF PECVD electrode 400 mm long. The coatings show plasmon resonance induced by the silver nanoparticles. A fine gradual antibacterial property has been shown. Surface analysis using XPS was used to measure the silver concentration in the thin film depth. This type of coating will be evaluated on larger machines.

IREIS starts a new thin film deposition equipment TSD 2800R with coating height of 2.8 meters. The vacuum chamber is equipped with three plasma sources based on cathodic magnetron sputtering, microwave PEVCD and ARC evaporation. Femto-second laser micro structuring process will also be associated to provide complete surface engineering solutions

Innovation features and advantages

- Research and development on large industrial machines.
- No need of process transfer for industrial phase.

Current and Potential Domains of Application	Numerous potential applications : - Mechanics with tribological characteristics, anticorrosions, hardness - Optical applications with reflective or anti-reflective layers, selective in wavelength - Provide Electric functions - Chemistry... Sectors can be: energy, automotive, aerospace, optic, healthcare
Intellectual Property Rights	Not Documented
Type of partner sought	Not Documented
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ITALY IDEA srl

Company

Keywords

Building materials, Composite materials, Materials Processing Technology, Materials for Magnetic Applications, Properties of Materials, Corrosion/Degradation

Technology request Reference: **TR_IT_010153**

Tactical shelter material developer looking for industrial and scientific partners

Technology description

The company developed a novel proprietary (US and EU patents granted) design for tactical shelter structures (registered trademark Titespan) already in use in the city of Milan and currently based on composite material. The new design allows for use of shelters in extreme conditions (wind speed, temperature, electromagnetism, etc.). Current development is under way for use in arctic environment and aerospace temporary hangars in desert areas. The company is interested in further development of the technology in order to allow mass production, possibly using a thermoforming material such as the new PVC oriented fiber systems or others. The company is looking for an industrial developer/manufacturer of the new material for mass production of shelters as well as for a technological/scientific partner for specific applications.

Innovation features and advantages

Specific advantages of the novel shelter design are:

- Reusability, transportability (folding/self-rigging based on the 463L cargo platform), air/weather tightness, high quality habitat.
- Upgrading is possible for use in extreme conditions: 250 kmh, highly contaminated areas, operations in temperature range -50°/+50°C, protection from electromagnetic interference in a wide frequency range.

More at www.titespan.com

Current and Potential Domains of Application	Military, expeditionary, emergencies, aerospace operations, temporary bases, scientific and pharmaceutical temporary scale projects.
Intellectual Property Rights	Patents filed/granted Copyright(s) registered Exclusive rights
Type of partner sought	- Industrial co-developer/manufacturer of the new material to be employed for mass production of shelters. - Technological/scientific partner for development in specific applications
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INTERNATIONAL Institut Laue-Langevin

Research center

Keywords

Materials testing, Fine Chemicals, Dyes and Inks, Plastics, Polymers, Properties of Materials, Surface analysis, Surface treatments, Superconducting materials

Technology offer

Reference: **RTD_FR_110854**

Neutron reflectometry technique to determine the surface properties of complex liquid mixtures

Technology description

Institut Laue-Langevin is a French institute which has developed a technique called neutron reflectometry that can be used to measure the structure and composition of surface layers. A reflectometer called FIGARO for horizontal free liquid samples was commissioned in 2009. Free liquid troughs can be used to determine the surface properties of mixtures at equilibrium. Additionally, we have now developed the technique for an overflowing cylinder where an expanding air/liquid interface mimics conditions relevant to the processing and applications of formulations. The dynamic surface results can be quite different to those measured under static conditions. Measurements on systems containing polymers and surfactants or indeed proteins and other biophysical mixtures are possible.

Innovation features and advantages

The structure and composition of surface layers at dynamic liquid interfaces can be uniquely resolved using the new technology we have at the ILL. For example, if an expensive new ingredient of a formulation is present at the interface under static conditions, is it really still working properly at the surface when the formulation is used under conditions far from equilibrium? The technology to resolve such questions for formulations then used in bulk has been rigorously tested at the ILL.

Current and Potential Domains of Application	The FIGARO reflectometer at the ILL already has over 30 peer reviewed publications. Beam time is distributed for academic users through a proposal review system but is also available commercially for companies and then the results don't need to be published. Static air/liquid troughs are available in addition to the new overflowing cylinder equipment and expertise and know-how is offered in support instrument users. Also the technique can be applied to solid films relevant to semi-conductors or solid/liquid interfaces such as solvent drying or molecular interactions.
Intellectual Property Rights	Exclusive rights
Type of partner sought	ILL is offering the FIGARO reflectometer to companies for dynamic surfaces measurement.
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INTERNATIONAL Institut Laue-Langevin

Research center

Keywords

Composite materials, Fine Chemicals, Dyes and Inks, Glass, Materials Processing Technology, Materials testing, Coatings, Materials for Magnetic Applications, Steel and stainless steel, Plastics, Polymers, Properties of Materials, Corrosion/Degradation, Superconducting materials

Technology offer

Reference: **RTD_FR_110455**

Role of neutrons to determine the structure of complex material under deformation

Technology description

Small angle neutron scattering is a technique that provides information about the structure of material in the length scale of 1nm to 600nm. Because neutrons are non-destructive and highly penetrating, they are very attractive to study in-situ material under complex environment. Additionally they offer an invaluable advantage to studying multicomponent systems through labeling by isotope substitution.

Innovation features and advantages

Most of industrial formulations are composed of mixture of polymer and colloidal particles. In order to uniquely resolve the material structural organization neutron scattering technique with contrast match technique can be used at the ILL. It is then possible to specifically highlight certain components of the material in order to precisely determine the internal structure of the mixture.

Current and Potential Domains of Application

There are 3 SANS spectrometers at the ILL that combine over thousands of peer reviewed publications. Beam time is distributed for academic users through a proposal review system but is also available commercially for companies and then the results do not need to be published. A diversity of sample environments is provided to users in order to tackle their research interests. This technique can be applied to bulk as well as film, with the possibility to follow kinetic processes due to the high flux reactor.

Intellectual Property Rights

Not Documented

Type of partner sought	Not Documented
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INTERNATIONAL Institut Laue-Langevin

Research center

Keywords

Building materials, Ceramic Materials and Powders, Glass, Materials Processing Technology, Materials testing, Materials for Magnetic Applications, Steel and stainless steel, Non-ferrous Metals and Alloys, Optical Materials, Properties of Materials, Corrosion/Degradation, Superconducting materials

Technology & Know-Offer Reference: **RTD_FR_110756**

Neutron Powder Diffraction

Technology description

Institut Laue-Langevin provides neutron powder diffraction as an easy tool for structural characterization of condensed matter. Due to the unique properties of neutrons as compared to X-rays, it allows for the characterization of magnetic ordering, the localization of light atoms as hydrogen, lithium or oxygen, the distinction of neighbor elements like iron/cobalt or aluminum/silicon, the ease of penetrating complex sample environments, thus in situ experiments, and the characterization of bulk properties of large samples.

Innovation features and advantages

- Fast data acquisition and straightforward analysis with Rietveld- and other methods.
- In situ examination of chemical and physical processes in real time
- Realization of extreme conditions in temperature and pressure
- Specific sensitivity for elements difficult to be localized by X-ray diffraction
- High precision in localization of atoms in crystal structures and thermal motion

Current and Potential Domains of Application

- Chemical processing, catalysis in situ
- Hydrogen storage materials, solid fuel cell materials, lithium batteries in situ
- Self-propagating high temperature synthesis and thermal explosion mode
- Magnetic ordering
-

Intellectual Property Rights	Not Documented
Type of partner sought	Potential customers with specific needs for material characterization of process investigation
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ITALY Istituto Nazionale di Astrofisica

Research organization

Keywords

Fine Chemicals, Dyes and Inks, Materials testing, Coatings, Optical Materials, Plastics, Polymers, Chemical, Research

Technology Offer
Know-Know Offer

Reference: **RTD_IT_010557**

Photochromic materials for adaptable optical metrology

Technology description

Photochromic materials are designed to be applied in optical interferometry. We demonstrated the feasibility of rewritable Computer Generated Holograms (CGHs) exploiting the reversible change in color of these materials. The CGHs have been used as reference surfaces in the optical test. Moreover, a fully adaptable and versatile point diffraction interferometer (PDI) has been implemented.

Interferometry is a well-established technique for the optical testing, but it is actually limited in the case of free-form/aspheric optics for the lack of reference surfaces. A Computer Generated Hologram (CGHs) is a smart reference, unique for any test optics. For this reason, a rewritable CGH, made with photochromic materials, is desirable to fit case by case the test optics. Moreover, if the CGH is integrated into the interferometer with the proper writing set-up, a fully adaptable tool can be developed, to on-line test optics of various shapes, with a fundamental impact on mirror production and testing. Beside this, we demonstrated a versatile point-diffraction interferometer (PDI) based on a thin photochromic film, where the tunable transparency of photochromic materials is exploited to optimize the fringe visibility, allowing to test optics of a wide range of focal ratios and optical quality.

Innovation features and advantages

ADVs:

- Design and synthesis of a new class of materials with tunable transparency and refractive index for optical applications
- Possibility to produce rewritable devices, customizable on request
- Possibility to develop a new interferometer to on-line test free-form optics, with the integration of the CGH, the writing setup and the test setup - a unique tool to assist mirror production

	REQs: - Photochromic materials require well-defined writing conditions. An efficient and accurate laser writing set-up, overcoming the limits of commercially available machines, to produce precise CGHs is required.
Current and Potential Domains of Application	This technology is now under development, in parallel with the new light-sensitive materials. The aim is to improve the field of optical metrology and to give the opticians a versatile tool to test free-form/aspheric optics. This concept deals with: - optics fabrication, to monitor the polishing/manufacturing steps through interferometry - astronomy, for the test and alignment of large and segmented mirrors Moreover, the expertise on photochromic materials we have acquired may open new applications into optics and photonics.
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ITALY Istituto Nazionale di Astrofisica

Research organization

Keywords

Optical Materials, Plastics, Polymers ; Research

Know-Know Offer
Technology or know-how request
Partner search for European project

Reference: **RTD_IT_011358**

Holographic Optical Elements for astronomical instrumentation: materials improvements.

Technology description	Holographic Optical Elements (HOEs) and in particular Volume Phase Holographic Gratings (VPHGs) have been used as very efficient dispersing elements in astronomical instrumentation. The common materials for making efficient VPHGs (sensitized gelatins) have a complex developing process and some variability. The possibility to find new materials suitable for volume holography, i.e. showing a refractive index modulation, can provide new opportunities in terms of size and performances of VPHGs. Photochromic materials, photopolymers and photosensitive materials have been considered and studied to this aim. The devices have been manufactured and characterized.
Innovation features and advantages	INN-ADV: design of innovative VPHGs based on new materials and processes on the basis of the requirements (astronomical, spectroscopic). REQ: new materials, compositions, showing improved performances in the field of volume holography.
Current and Potential Domains of Application	The applications are in the field of astronomical spectrographs as dispersing elements. Other fields for the application of these devices are in the spectroscopy (UV-vis, Raman) and in optical systems bearing holographic elements, optical tunable filters.

EEN Contact

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Email: angela.pulvirenti@fast.mi.it
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SWITZERLAND

Institut des Microtechnologies Appliquées Arc, Haute Ecole-Arc Ingénierie

Research Organisation

Keywords

Composite materials, Materials testing, Coatings, Steel and stainless steel, Non-ferrous Metals and Alloys, Plastics, Polymers, Properties of Materials, Corrosion/Degradation, Surface analysis, Surface treatments

Technology and Know-How Offer
Partner search for European project

Reference: **RTD_CH_010159**

MeV ions for materials surface characterization and large area micro and nanostructuring.

Technology description

Ionlab-Arc is a research group part of Institut des Microtechnologies Appliquées Arc in La Chaux-de-Fonds (Haute Ecole Arc Ingénierie).
Ionlab-Arc is based around a 1.7 MeV (mégaelectron volt) Pelletron accelerator facility that is used as a potent tool for science and technology.

The facility is used for:

Surface modification:

⁕ Ion irradiation to modify the surface properties such as hardness, friction coefficient, cell-adhesion, colour and impurity doping, (possibility to implant any element).

⁕ Micro and nanopatterning of areas up to 3.5×5 cm (even non-planar).

Surface characterization:

⁕ Rutherford backscattering analysis for in depth elemental analysis.

⁕ Particle induced X-ray emission (PIXE) for trace element content.

⁕ Elastic recoil detection analysis for in-depth analysis of hydrogen

⁕ Time of flight ERDA for analysis of all light and heavy elements in depth.

Surface imaging:

⁕ Mapping of trace elements with PIXE (~5 µm resolution)

⁕ 3D profiling with micro-RBS (~1 µm resolution)

⁕ Characterization of conformal edge structures with Direct-STIM

Innovation features and advantages

Ionlab-Arc specialises in prototyping and materials testing for the watchmaking and biomedical industry and research. We seek partners for projects in fundamental and advanced coatings science and industrial technology, micro- nanoporous membrane technology, biocoatings, simulation of irradiation effects in materials and biological tissues. Other areas of research and technology are high speed electronics (MCP read-out and gas ionisation detectors)

In conjunction with Ionlab-Arc there are on-site facilities at Institut des Microtechnologies Appliquées Arc for:

Laser machining
fs and ps lasers of electrode structures, laser marking etc.

Thin film deposition of advanced coatings
PVD, CVD ALD of metals and oxides, nitrides etc , parylene deposition, nanolaminates, moisture barriers

Microalalysis
Optical, confocal and scanning electron microscopy, XPS, EPMA,

Metallurgical testing
Pin on disc, microhardness

Current and Potential Domains of Application

Materials modification
Corrosion resistance, hardness high temperature resistance and triblogical improvement, microfluidic devices, diffractive optics, integrated optical wavegides, micro- nanoporous membranes, decorative coatings, doping, ion beam mixing, simulation of irradiation effects in materials and

biomedical tissue (incl. Ion beam cancer therapy) micro- nanomaching silica and glass. MeV ion beam lithography.

Ion beam analysis
Thin-film charcterisation, corrosion processes, triboprocess analysis, biomedical coatings, oxide/nitride/carbide layers, nanolaminates, interfacial oxidation, diffusion processes, hydrogen ingressment analysis, trace element analysis, photovoltaic cell structures,

Elemental mapping
Proton induced fluorescence (scintillation materials testing), metal jointing (e.g. solder wetting) Whole cell imaging in biology, analysis of coating conformity in holes and cavities

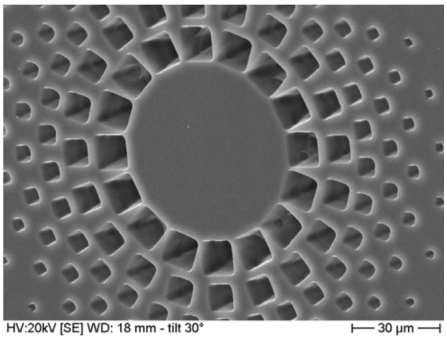
Intellectual Property Rights

Patents filed/granted
Copyright(s) registered
Exclusive rights

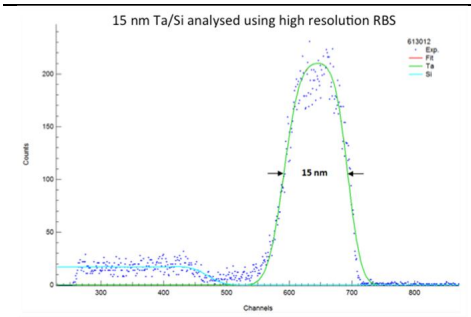
Type of partner sought

We seek partners for National, CTI and EU collaborations as well as consultancy projects. in the materials and coatings fields. Also partners interested in the ion-beam development (we wish to try to set up a collaboration to develop high brightness proton ion sources) as well as using MeV ion beam to develop new pharmaceuticals for use in ion beam cancer therapy.

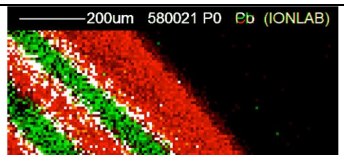
Pictures



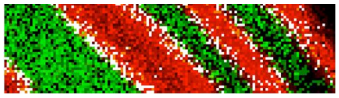
Micromachined PTFE



High resolution RBS of Ta thin film



Wetting (white) of a copper (red) wire by Pb (green)



EEN Contact

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ISRAEL — Israel Aerospace Industries (IAI)

Company

Keywords

Composite materials, Glass, Materials Processing Technology, Coatings, Optical Materials, Properties of Materials, Corrosion/Degradation, Surface analysis, Surface treatments, Telecommunications, Environmental technology, Energy, Aeronautic/Aerospace, Electronics/Semiconductors, Research.

Technology offer
Technology or know-how request
Partner search for European project

Reference: **TO_IL_020460**

Advanced Materials & Surface for Aerospace and Electronics Industry

Technology description

IAI is a leading Aerospace & Electronics company with a wide range of products and services, ranging from Aircraft conversion to Radars, UAV systems, Avionics, Communication, Optics and Satellites manufacture. Materials and Surface Technologies play a major role in the successful implementation for our products and services.
IAI is constantly searching for the latest most advanced technologies to use in these and other applications.

Innovation features and advantages

We are interested in the latest advances in innovation in many areas including:

- Composite Nanotechnology for Surface applications
- Advanced Methods for Composite Materials Manufacturing
- Micro & Nano Electronic Materials for High Power Applications
- Optical Materials for High Power Lasers
- Bonding Materials for Electronics & General Aerospace Applications
- Materials for Electric Propulsion (e.g. batteries, fuel cells)

Current and Potential Domains of Application	• Aircraft Platforms • Radar Systems • Lasers • Optics • High Power Electronics • Electrically Powered UAV Systems
Intellectual Property Rights	Others (registered design, plant variety right, etc.).
Type of partner sought	IAI is interested in any partner (Companies or/and academic institutes) who can either supply us with the latest technologies in the areas mentioned, or who is interested in joint development projects in these areas.
EEN Contact	**ISERD - The Israel-Europe R&D Directorate** *Uri Fishelson* Email: uri@iserd.org.il Tel: +972 (0)3 5118171

FRANCE LAM PLAN

Company

Keywords

Surface treatments

Technology Offer Reference: **RTD_EF_021973**

Polishing and lapping technology

Technology description

LAM PLAN manufactures equipment and products for lapping and polishing processes.
World specialist in super finish, LAM PLAN covers all the needs related to abrasive polishing in the industry : study of methods and implementation of design, development and manufacturing of diamond suspensions, polishing cloths, pads and machines. A unique know-how in the field of polishing.

Our technologies provide excellent flatness and roughness on a wide range of materials.for analysis of all light and heavy elements in depth.

Innovation features and advantages

Research and Development have been at the heart of our activity for more than 50 years. LAM PLAN is continuously innovating and could provide for numerous contributions which revolutionized on several occasions the polishing technologies.
LAM PLAN is a leader in the polishing sector thanks to this capacity to innovate and the quality of the resulting products.

LAM PLAN received the 2011 INNOVATION PRIZE for its new VOC-free diamond suspensions.

Current and Potential Domains of Application

Our technologies are used in the following industries :

- Semiconductor
- Micro-electronics
- Optical industry
- Automotive

- Aerospatiale
- Medical
- ….

Intellectual Property Rights	Patents filed/granted
Type of partner sought	Reasearch organisations for testing products and collaborative projects Looking for suppliers

Pictures

Abrasive liquids

Boring machine

Polishing machine

EEN Contact

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SWITZERLAND LS Instruments AG

Company

Keywords

Nanoparticles, Ceramic Materials and Powders, Composite materials, Fine Chemicals, Dyes and Inks, Materials testing, Coatings, Optical Materials, Plastics, Polymers, Surface treatments

Technology & Know-How Offer
Partner search for European project

Reference: **TKHO_CH_110261**

Dynamic and Static Light Scattering Technologies Offer

Technology description	LS Instruments offers high-end custom solution in the field of light scattering: Dynamic and Static Light Scattering, Diffusing Wave Spectroscopy, Small Angle Light Scattering or Optical Microrheology.
Innovation features and advantages	We work intensively with fundamental research institutes as well as industrial laboratories of the large market leaders
Current and Potential Domains of Application	Integration with X-ray or Neutron Scattering facilities of Dynamic and Static Light Scattering, Diffusing Wave Spectroscopy, Small Angle Light Scattering or Optical Microrheology
Intellectual Property Rights	Patents filed/granted Secret know-how

Type of partner sought	Industrial or academic key laboratories - interest in R&D collaborations, technology licensing
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ROMANIA

National Institute for Laser, Plasma and Radiation Physics

Research center

Keywords

Coatings, Materials for Magnetic Applications, Optical Materials, Surface analysis

Technology offer Reference: **RTD_RO_020962**

Nanostructured thin film preparation using thermionic vacuum arc (TVA) technology

Technology description

The National Institute for Laser, Plasma & Radiation Physics (INFLPR) is an independent, national importance research institution established by the Government of Romania. INFLPR was founded in 1977, with the mission to advance the knowledge in several strategic areas of the sciences and technologies related to laser, plasma, and radiation physics.

Thermionic vacuum arc (TVA) technology consists in depositions of the thin films by an electrical discharge which is ignited in an atmosphere of pure vapors. The vapors are generated by the energetic action of electrons coming from an external heated tungsten cathode filament.
The thermoelectrons firstly emitted by the cathode are accelerated in high vacuum conditions towards the anode on which a high positive potential is applied (1-4 kV). This way the anode material is heated by electron bombardment, is evaporated, and a pure vapor atmosphere is created around the anode whose pressure increases until plasma is ignited by electron - vapor particle collisions. These space particles, neutral or ionized, are expanding in the surrounding vacuum and are deposited on the substrates.

Depositions of magneto-resistive multilayered thin films were obtained by alternating discharges of Cu, FeNi alloy and FeMn alloy. MgF2-Co granular films presenting TMR effects were successfully prepared by the TVA method. The films with different Co cluster concentrations were obtained by settling film substrates at different distances from the Co and MgF2 evaporation sources. A maximum TMR effect of was obtained at room temperature for a relative content of 40at%Co.
Depositions of the composite materials using TVA technology for fusion

applications reveal the diffusion processes of W and C atoms inside the Be layer, more pronounced in the case of C upper layer, while thermal annealing induces a strong interfaced diffusion and intermixing of the whole structure into the Be layer.
Using the thermionic vacuum arc technology could be prepared Ni-Re-Cr mixed films in order to obtain thermal barrier coatings for applications in metallurgy and aeronautics/aerospace.

Innovation features and advantages

- the high purity of the layers (high vacuum conditions)
- no gas consumption;
- the films are growing from the plasma created in the pure vapors of the evaporating material
- the formed films are continuously bombarded by the genuine ions and the advantages are:
    - no gas inclusions
    - good adherence
    - the ions energy can be controlled by cathode external heating and anode voltage
    - the deposition rates = 1 to 10 nm/sec

Current and Potential Domains of Application

Scientific research: preparation of pure and mixed nanostructured films for new technological applications
Electronics: preparation of magnetorezistive thin films
Optics: preparation of optical/protective coatings including pure metals, oxides and diamond like films
Nuclear energy (fission and fusion): preparation of beryllium coatings as brazing material in fission technology and coatings for fusion device first wall (Be and W coatings)
Space: preparation of beryllium and boron membranes for X-ray and neutron detectors

Intellectual Property Rights

Patents filed/granted

Type of partner sought

Looking for partners (universities, research centers) able to apply with us to the common research projects.
Looking for companies to transfer the technology to industrial applications.

Picture(s)

TVA plasma running in pure chromium vapors

EEN Contact

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ROMANIA

National Institute for Laser, Plasma and Radiation Physics

Research center

Keywords

Surface treatments, coatings – Energy, Industrial machinery/processes, Automotive, Research

Technology offer Reference: **RTD_RO_020963**

Combined Magnetron Sputtering and Ion Implantation technology

Technology description

The National Institute for Laser, Plasma & Radiation Physics (INFLPR) is an independent, national importance research institution established by the Government of Romania. INFLPR was founded in 1977, with the mission to advance the knowledge in several strategic areas of the sciences and technologies related to laser, plasma, and radiation physics.

Combined Magnetron Sputtering and Ion Implantation (CMSII) is a PVD (Physical Vapor Deposition) technique involving simultaneous deposition of thin coatings and high energy ion bombardment (tens of keV) of the coating by high voltage pulse discharge. Based on this technique a specific technology and equipment was developed from laboratory to industrial scale and successfully applied for tungsten coating of carbon based materials (CFC- Carbon Fibre Composite and Fine Grain Graphite) for the first wall in fusion devices. More than 3000 of plasma facing components were coated with W layers of 10-15 μm and 20-25 μm for JET (Joint European Torus), Culham, UK and ASDEX Upgrade, Garchnig, Germany tokamaks. JET is the biggest operational tokamak in the world.

The CMSII technique is very flexible. Besides W coatings, other coatings such as nc-Ti_2N/nc-TiN, VN, VCN, ZrC, ZrCN, etc. have been deposited on metallic substrates for various applications. Thin coatings (2-5 μm) of Cu or Mo were deposited on ceramic substrates (alumina and BN).

The deposition chamber of the existing CMSII equipment has a diameter of 0.8 m and a height of 0.75 m. It is equipped with 24 magnetrons. The maximum power of the equipment is 25 kW.

Innovation features and advantages

As a result of the periodical ion bombardment of the coating the following effects occur:
(i) a high densification of the layer leading to formation of nano-structures, (ii) a stress relief at the interface and within the layer and (iii) a small enlargement of the coating-substrate interface which might be responsible for improved adhesion. Relative thick layers (10 – 30 μm) with a very good adhesion to the substrate have been produced by this technique.
In the R&D phase of the ITER-like Wall project at JET it was demonstrated that CMSII technology produced W coatings on CFC with higher performances in terms of thermo-mechanical properties in comparison with other ten different PVD or CVD (Chemical Vapor Deposition) technologies. The W coatings were tested at high heat fluxes up to 23 MW/m^2 when the surface temperature exceeded 2000 °C and at cyclic thermal loading (200 pulses) at 10.5 MW/m^2 for 5 s. The W coatings deposited by CMSII technology were the only ones which survived these tests without delaminations.

Current and Potential Domains of Application

The current applications of the CMSII technique in the field of nuclear fusion are:
- W coating of carbon based materials for the first wall
- Multilayer markers W/Mo/W/Mo and C/Mo deposited on carbon materials for erosion studies
- Mo coating of BN for special magnetic sensors

Potential development for other applications:
- Low friction and high wear resistant coatings for automotive and hydraulic sectors
- Combined treatments (laser alloying/dispersing/cladding, plasma nitriding, CMSII coating) for moulds and forging dies.

Intellectual Property Rights

Others (registered design, plant variety right, etc)

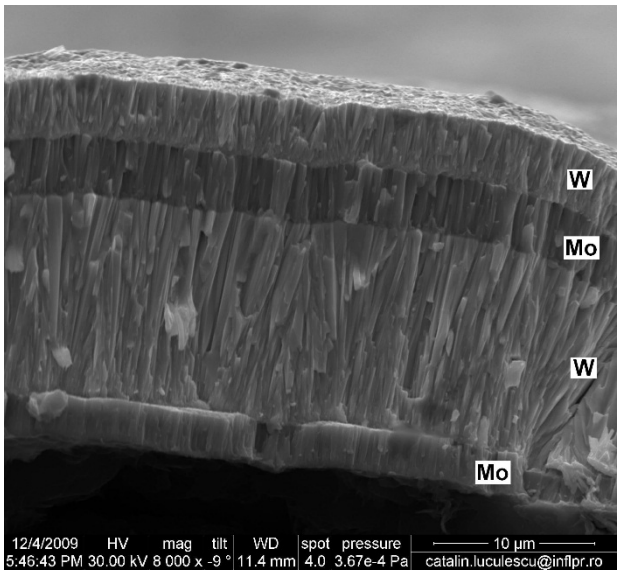
Type of partner sought

Specific requirements for partners :
- Companies interested in new innovative surface treatments/coating for improving the wear, tribological and corrosion resistance of the mechanical components.
- The companies should have the possibility to provide components (demonstrators) for experiments
- The companies should have the capability of testing the treated components under industrial conditions

- Companies interested in high temperature resistant coatings for various applications

Picture(s)

W-coated CFC tiles by CMSII technology for JET divertor



Multilayer Mo/W/Mo/W marker for JET divertor used for erosion studies

Additional Comments

- The CMSII coating technique is very flexible. The actual deposition area has a diameter of about 400 mm and a height of 370 mm. The components are rotated during the deposition to achieve a good coating uniformity. During the deposition process the temperature of the components to be coated reaches about 350 °C.
- In addition to the CMSII equipment, in the Plasma Surface Engineering Lab. from our institute there is an industrial Plasma Nitriding Unit of 70 kW, equipment for surface characterization (optical microscopes, microhardness testers, Glow Discharge Optical Spectrometer, etc.) and testing.
- Recently an industrial laser equipment of 3 kW TruLaser 3001 with a six axes robot able to perform laser alloying/cladding on complex geometries was installed and commissioned.
- In this way our institute has a unique capability to perform at industrial scale complex surface treatments and coatings for various components.

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ROMANIA

National Institute for Laser, Plasma and Radiation Physics

Research center

Keywords

Composite materials, Materials testing, Coatings, Superconducting materials (technology Field), Energy, Aeronautic/Aerospace, Automotive, Research (Application field)

Technology offer Reference: **RTD_RO_110464**

Advanced X-ray imaging for composite and superconducting materials and structures

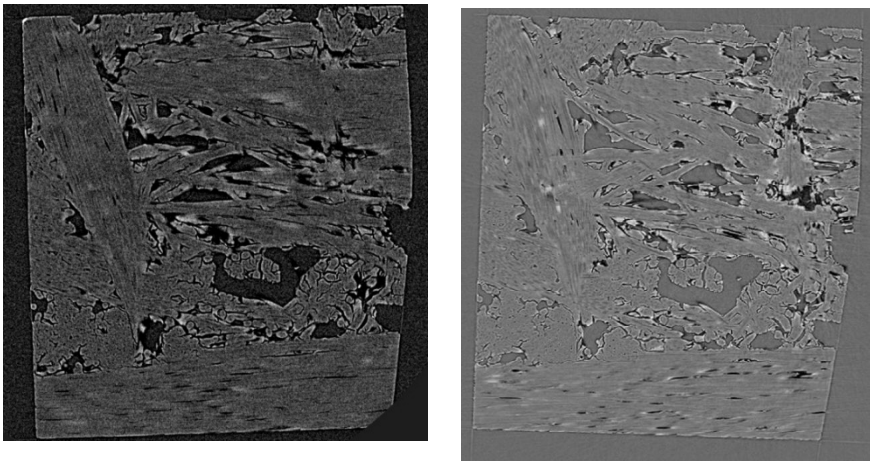
Technology description

The National Institute for Laser, Plasma & Radiation Physics (INFLPR) is an independent, national importance research institution established by the Government of Romania. INFLPR was founded in 1977, with the mission to advance the knowledge in several strategic areas of the sciences and technologies related to laser, plasma, and radiation physics.

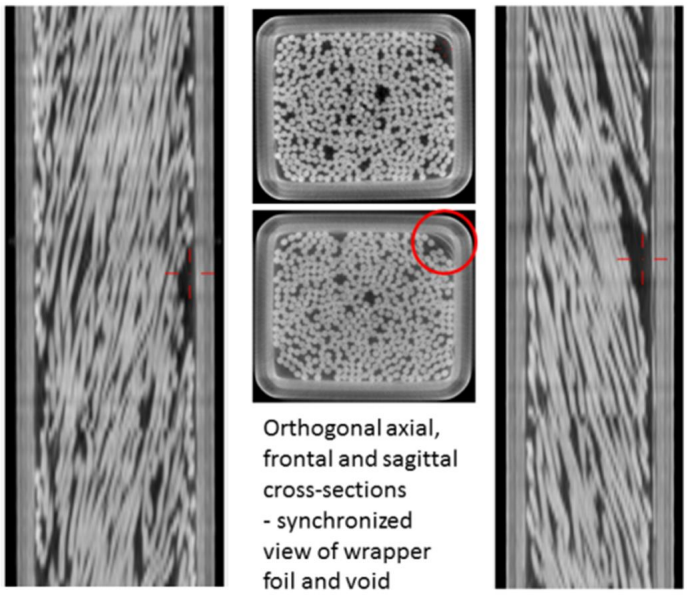
X-ray Computed Tomography (XCT) system using a nano-focus X-ray tube and high resolution flat panel X-ray detectors that allows the acquisition of transmission data in cone- and fan-beam geometries and processing algorithms to provide 2D and 3D imaging with submicron resolution. The delivered images can be used to define precise positions on the surface of the sample, to perform elemental analysis by using X-ray fluorescence analysis capability of system and the same motion stage for the sample.

Innovation features and advantages

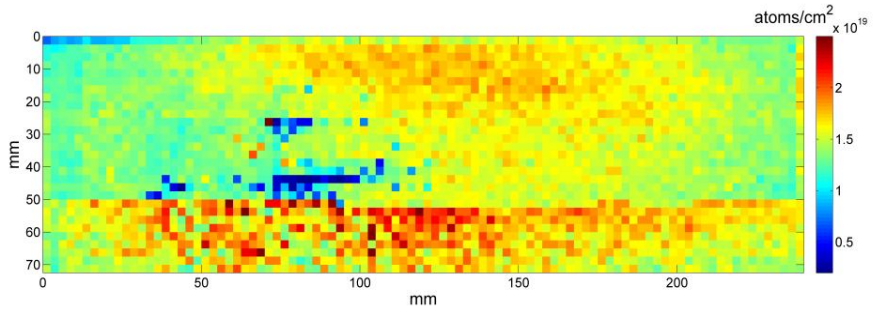
The XCT is an open system which allows a very high versatility of the scanning configurations.
The software is highly optimized for multi-processor and multi-core computing configurations and can exploit the computing capabilities of contemporary graphics processors.

Current and Potential Domains of Application	A combination of X-ray imaging techniques (mictotomography and microbeam fluorescence) is employed for the microstructural characterization of coated/impregnated carbon based composite materials (Carbon Fiber Composites and Carbon fiber reinforced ceramics - Cf/C and Cf/SiC) and the complex structures as hybrid metal ceramic structures, superconducting materials in all forms (bulk, multifilamentary strands and cables in conduit). These techniques provides the NDT evaluation of the porosity network of composites, dissimilar materials joining, superconducting materials parameters. High productivity quantitative determination of metal coating thickness on large areas carbon based materials is also demonstrated. Its main advantages are: i) working in air on relatively large samples (max. 300x150 mm^2) without the need for sample preparation, ii) the measurement time per point is relatively short (down to a few seconds), iii) the measurable thickness range for W is much larger than in other methods (from <10 nm to >20 μm).
Intellectual Property Rights	Patents granted
Type of partner sought	Not Documented
Picture(s)	

Very good agreement between our laboratory microXCT and ESRF Synchrotron CT



All constitutive elements of Cable-in-Conduit-Conductor type superconductors (jacket, strands and external wrapper foil) can be noninvasively inspected. Corner void and wrapper foil overlapping are outlined.



Two-dimensional map of the tungsten thickness coated on fine grain graphite tile.

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ITALY NTET Spa

Company

Keywords

Composite materials

Technology offer Reference: **TR_IT_010465**

Carbon based technopolimers for special applications

Technology description	NTET has developed in the last 3 years a specific experience in designing and producing parts for the automotive sector produced with a special composite material: a carbon fiber reinforced SMC (C-SMC) licensed to us by the US Company Quantum Composite. The production technology is compression-molding.
Innovation features and advantages	This technique allows to produce high-performances carbon-based plastic components, with low weight, low thickness, HDT>200 °C but obtained by an industrial process which assures constant ouput (10 parts/h), constant quality and uniformity of all parts. Cost-wise this NTET solution meets relatively-low cost targets.
Current and Potential Domains of Application	Structural parts as frame elements, support for thermal shields etc
Intellectual Property Rights	Secret know-how
Type of partner sought	Not Documented

EEN Contact

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ITALY POLITECNICO DI TORINO

Research organization

Keywords

Building materials, Ceramic Materials and Powders, Glass, Materials Processing Technology, Materials testing, Coatings, Materials for Magnetic Applications, Optical Materials, Surface treatments

Know-how & Technology offer Reference: **RTD_IT_110166**

Glasses, Ceramics and Composites (GLANCE)

Technology description

Politecnico di Torino (POLITO), one of the most well-known technical universities in Italy, provides since 1906 education and research in engineering, with particular attention and links to their application in industry.

In particular this research group “Glasses, Ceramics and Composites” (GLANCE) has been working for 20 years at the Applied Science and Technology Department (DISAT). We develop and characterize "custom" glasses, glass-ceramics and their composites, in the form of bulk-, joining-, coating-, porous-, thin films- and fibre-materials as well as surface modified metals.

POLITO researchers have funded many Spin-Off Companies, two of which involve GLANCE researchers (Bionica Tech s.r.l. and Acacia s.r.l.).

The group is active in the following fields:

BIOMATERIALS:

- Bioactive glasses, glass-ceramics, ceramics and composites, as coatings or bulk or 3D-porous materials commonly used for bone substitutions and tissue engineering;
- Mesoporous particles for drug- delivery application and targeted ion release, magnetic nanoparticles for target therapy.
- Bioresorbable phosphate based glasses as particles, scaffolds and fibers for nerve and tissue regeneration;
- Surface functionalization of metal and glasses with proteins or enzymes for implantable devices or bio-sensors.
- Magnetic biomaterials (on the macro-, micro- and nanoscale) for

hyperthermic treatment of cancer, magnetic drug targeting and immunological drug targeting.

- Multi-purpose antibacterial materials and coatings, for implantable devices or every-day life surfaces.
- New surface treatments to enhance biocompatibility, wear resistance and bioactivity of metallic materials (Ti and Ti-alloys, Co-alloys and nitinol);

MimeTi nanostructured surface to increase the osteointegration and to lower the risk of infection of Ti and Ti alloys implants (Bionica Tech s.r.l., EU patent granted).

- Antibacterial cements for orthopaedics applications, osteoinductive and bioresorbable injectable cement for spinal surgery (Bionica Tech s.r.l.)

JOINING & COATING:

"Custom" joints and coatings for different materials (metals, ceramics, composites and glasses) and applications in the fields of: aerospace, biomaterials, energy production, high temperature, photonics, thermonuclear fusion technology, solid oxide fuel cells (SOFCs). Coatings are applied by low cost methods (i.e. slurry) or by sputtering.

- Silica-based glass-ceramic sealants for solid oxide fuel (SOFC) cells and solid oxide electrolysis cells (SOEC)
- Thin film barrier layers for SOFC and SOEC devices

PHOTONICS:

- Custom glasses for photonic devices: passive and rare earth doped glasses (silicate, germanate, phosphate, tellurite), photosensitive glasses, and glasses for poling. Pre-competitive research by supplying medium-high quantity of special glasses for photonics.
- Direct bonding of active/passive glasses
- Design, fabrication and characterization of optical fibres for fibre lasers, near and mid infrared sources and optical sensors

WASTE MANAGEMENT:

- Recycling of vitrified and not vitrified wastes to produce tiles, mortars, concretes and bituminous conglomerates

MAGNETIC-OPTICAL GLASSES:

Magnetic-optical glasses are studied for gas sensing for the car industry and Magnetic –optical Current Transducer (MOCT)

A wide range of characterization techniques are available, together with experimental facilities (high temperature furnaces, clean room, cutting and polishing machines, fibre drawing tower, high temperature controlled

	atmosphere isostatic hot press, profilometry, refractometer, spectroscopies, thermal analysis, microscopic analysis, facilities for biological medical treatment, sputtering, micro-CT Skyscan 1174, Spray-Dryer, mechanical tests, X-ray diffraction) and with the necessary expertise to discuss results and to propose solutions. Problem solving applied to materials is currently provided to companies and SMEs. More details at: http://www.composites.polito.it
Innovation features and advantages	Research contracts include: 1. Explorative, high risk research (1-3 month projects, go/no-go approach) at POLITO in NDA regime 2. Timely problem solving activity of POLITO for company 3. Sharing of POLITO know-how and background 4. Customized IPR conditions 5. Use of POLITO equipments/laboratories as company outsourced research lab 6. Custom training&lecturing for company personnel 7. POLITO multicultural environment as an asset for company 8. Common participation to EU/national projects as a return of investment for company 9. www.polito.it/imprese/incentivi
Current and Potential Domains of Application	- Biomaterials - Aerospace - High temperature applications - Photonic - Energy production - Waste management
Intellectual Property Rights	Patents granted Secret know-how Patent(s) applied for but not yet granted
Type of partner sought	- SME - Research centers - Universities.

EEN Contact

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ISRAEL Ray Techniques Ltd.

Company

Keywords

Coatings, Surface treatments, Materials and Powders, Colors and varnish, Composite materials, Fine Chemicals, Dyes and Inks, Optical Materials, Plastics, Polymers

Technology offer Reference: **TO_IL_020967**

Nanodiamonds powder of high purity and wide range of its applications

Technology description

Ray Techniques Ltd. is an Israeli company engaged in the fabrication of nanodiamonds and nanodiamond compounds by proprietary technology and in the development of novel nanodiamond applications.

Unique properties of diamond: highest hardness and wear resistance, highest thermal conductivity and very good electrical insulation, optical transparency from deep UV to far IR; wide band gap, high refractive index, highest sound propagation velocity, chemical and radiation resistance, biological compatibility and others, define its applicability in various fields.

Nanodiamonds powder consists of inert diamond nanocrystals with average size of 4-5 nm covered by surface functional groups. Nanodiamonds are usually highly agglutinated. Been uniformly introduced within any media, nanodiamonds transfer their unique features to the matrix material enabling creation of new compounds and objects with desired properties. Currently nanodiamonds are used in fine polishing, lubricating, coating, in polymers, in energetic compositions and biological research. New applications in Thermal Management, energy storage, analytical chemistry, cold fusion, drugs, diagnostic kits and other applications are under development.

To reach desired performance nanodiamonds have to undergo special process of surface modification, disaggregation and covalent bonding with molecules of a chosen material. Therefore, special process of surface functionalization should be developed for each basic material.

The company is engaged in the following nanodiamonds technologies:

1) Synthesis nanodiamonds by laser treatment of multi-component targets containing pure carbon soot and hydrocarbons
2) Nanodiamonds surface functionalization and dispersing nanodiamonds within various solvents
3) Design novel composite materials with desired properties exploiting unique features of nanodiamonds

Innovation features and advantages

1) A new approach for the producing nanodiamonds is based on the creating acoustic shock-waves by radiation beam focused in the transparent liquid at the some predetermined distance from the surface of a specially prepared solid target containing carbon non-diamond source. Treating the specially prepared target by the acoustic shock waves leads to the forming of diamond nanocrystals. Our technology in contrast to the existing one is controlled, non-hazardous and non-polluting, enabling nanodiamonds of high purity and free of metals.
2) A new approach for producing stable nanodiamonds suspensions is based on surface modification and dispersion within diverse solvents. The company developed special technique to reach full disaggregation.
3) Novel formulations in the fields of antifriction treatment, Thermal Management and cooling have been developed and indicated high performance of nanodiamonds in these compositions.

Current and Potential Domains of Application

Current:

- Pastes, gels, slurries for lapping / polishing / finishing
- Additives to galvanic electrolytes and chemical deposition solutions
- Additives to lubricants
- Fillers in various polymers
- Precursors for CVD coatings
- Cosmetic products additives
- Energetic agents in propellants

Potential:

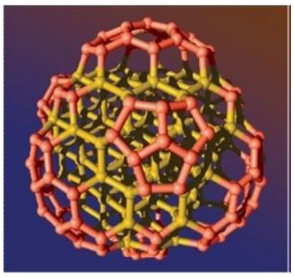
- Thermally conductive and electrically insulating compounds (grease, adhesives, substrates)
- Electrodes for supercapacitors and batteries
- Reinforcing agents in polymers
- Additive in nuclear fuel
- Drug and gene delivery agents
- Biosensors and diagnostic kits
- Optical filters

- High refractive index for transparent polymers (field emission displays, LEDs)
- Agents for separation and purification of proteins
- Quantum computers
- Cold fusion systems

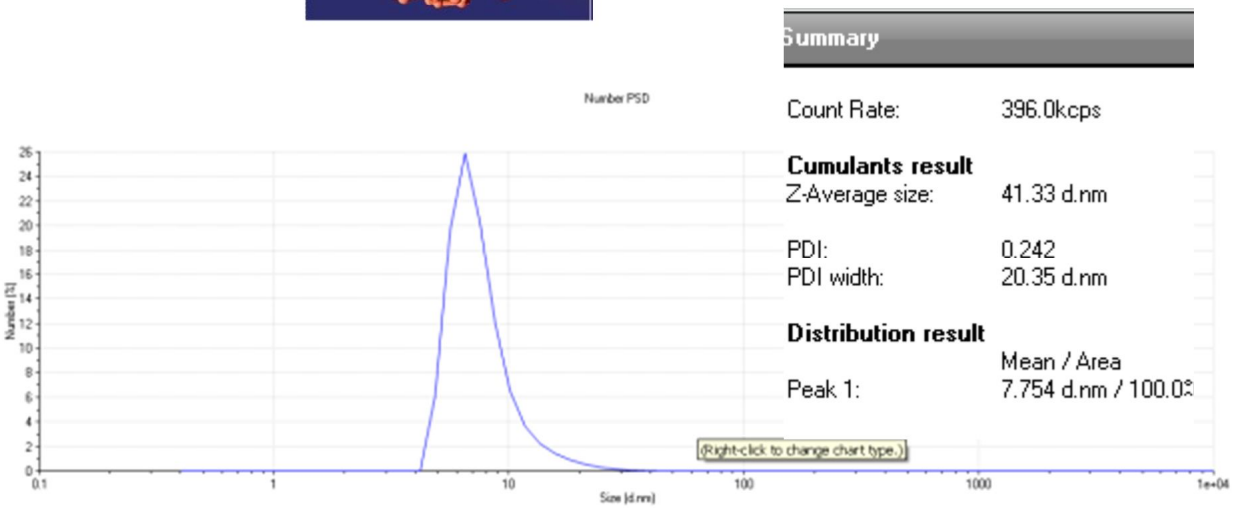
Intellectual Property Rights

Patent(s) applied for but not yet granted

Picture(s)



Scheme of nanodiamond



DLS: 7.75 nm analysis of 1.7 Wt. % ratio nanodiamonds in water slurry: PSD

Type of partner sought

The company's role could be to develop nanodiamonds containing composite for special needs of partners in joint research

EEN Contact

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FRANCE RX SOLUTIONS SARL

Company

Keywords

Materials testing, Properties of Materials, Corrosion/Degradation

Technology & Know-How Offer Reference: **TKHO_FR_110868**

X-Ray non destructive testing specialist (Digital Radioscopy and 3D CT Scan)

Technology description

RX Solutions is a manufacturer of automated X-Ray imaging equipment and offers engineering services in radioscopy and 3D CT Scan.
Whether for quality control, examination of an item or solving design problems, our customers are public or private laboratories and research centers. RX Solutions particular expertise is recognized in materials, electronics, automotive, watches, aerospace, biomedical, ...

Innovation features and advantages

As a manufacturer of X-Ray equipment with a R&D dedicated team (for software and hardware), RX Solutions is always improving his equipment and is aware of current issues by the engineering services team regularly confronts to complex problem and specific analysis like “under pressure acquisition”.
With this cooperation between R&D and services teams, RX Solutions has already developed new 3D CT Scanning technics as laminography, helicoid acquisition, nano-tomography, already used for materials investigation.

Current and Potential Domains of Application

- Materials (ceramic, composites, plastics, polymers, Metals, glass, superconducting…)
- Aeronautic/ Aerospace
- Automotive
- Electronics/ Connectics
- Pharmacy
- Energy
- Military
- and various other fields like jewelry, arts, …

Intellectual Property Rights

Patents filed/granted
Secret know-how

Picture(s)

Figure 2: DeskTom

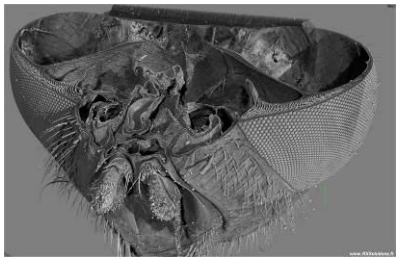

Figure 3: Tomographie d'une tête de mouche

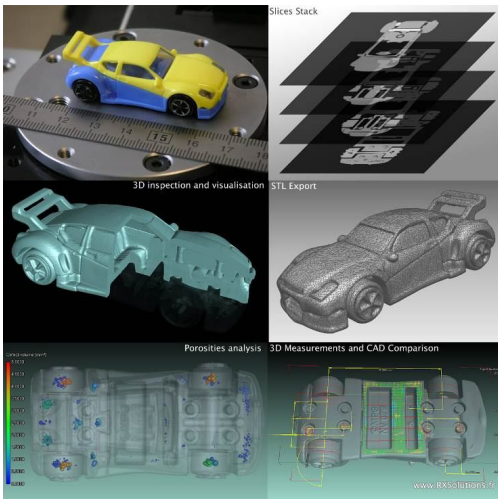

Figure 1: Post traitements en tomographie

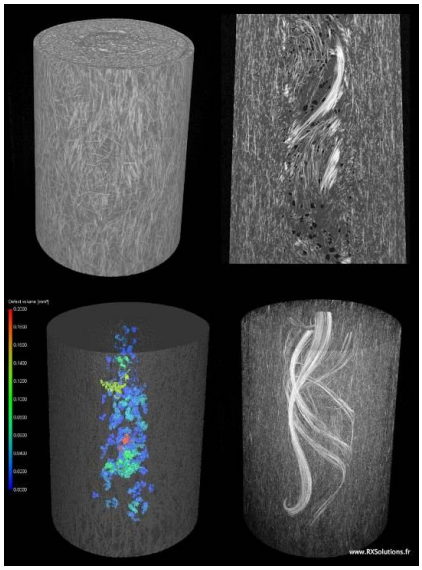

Figure 4 : Tomographie Composites

Type of partner sought

Not Documented

EEN Contact

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FRANCE SAMES Technologies

Company

Keywords

Ceramic Materials and Powders, Composite materials, Glass, Materials Processing Technology, Coatings, Steel and stainless steel, Non-ferrous Metals and Alloys, Optical Materials, Paper technology, Plastics, Polymers, Properties of Materials, Corrosion/Degradation

Technology offer Reference: **TO_FR_020969**

New surface deposition method - electrostatic pulverization

Technology description

SAMES Technologies is a manufacturer of equipment for electrostatic pulverization. Our products are used mainly in the automotive market (paint). SAMES Technologies equips production lines for car manufacturers all over the world.

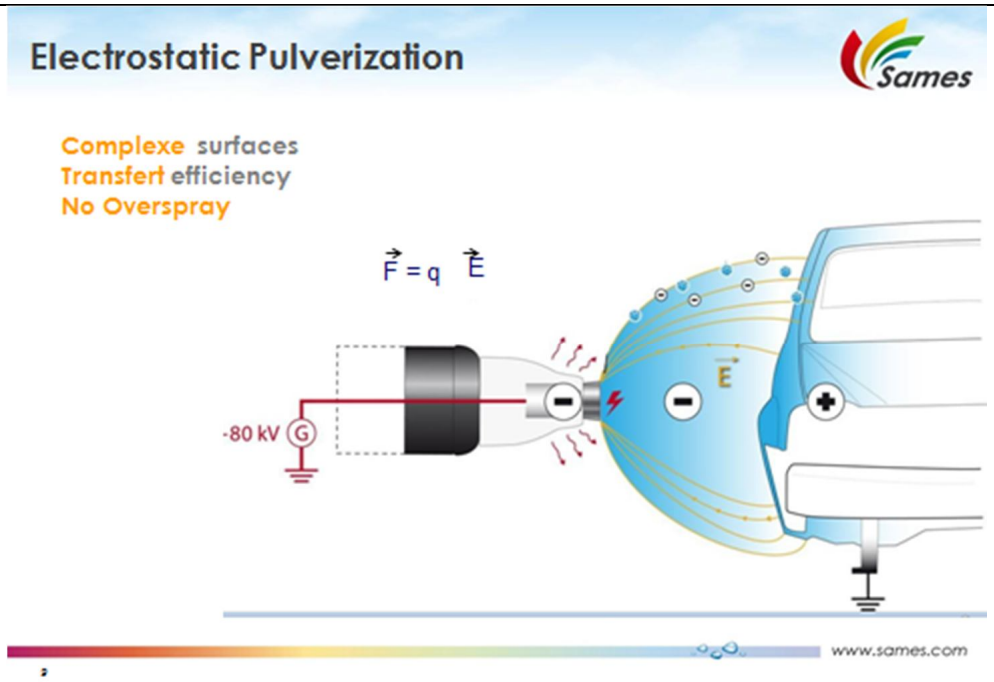
Since last year, Sames has issued a diversification project, which aims at using the electrostatic pulverizators for spraying products other than paint, sol gel solutions for example. We have produced successful trials and would like to expand our field of applications or customers in the general industry branches for the application of sol-gels coatings.

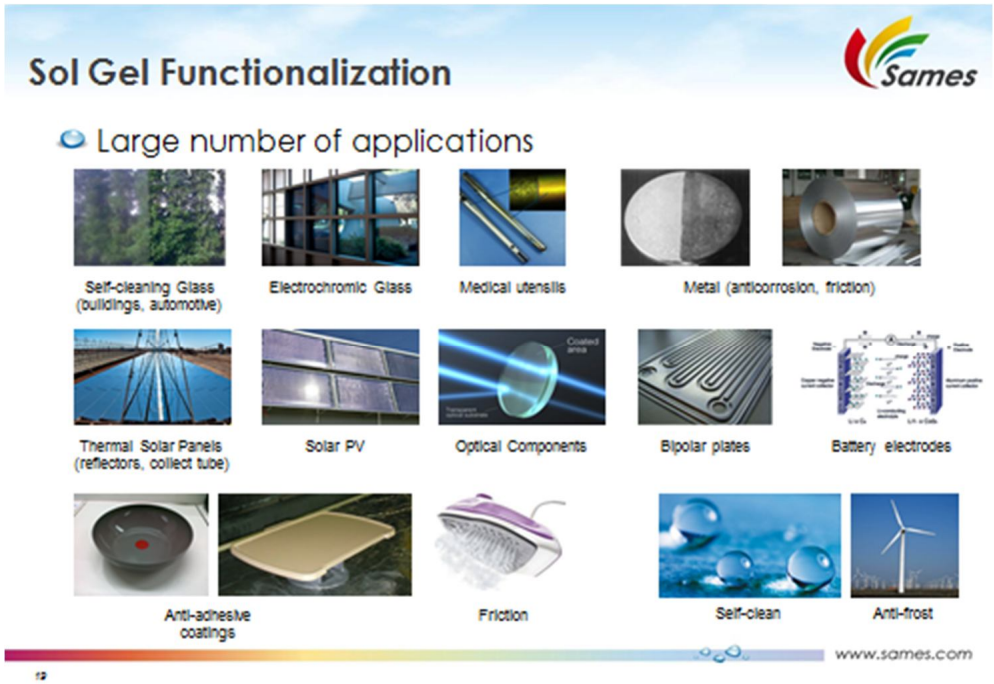
Innovation features and advantages

The purpose of this project is the evaluation and qualification of a new industrial process for applying surface functionalization layers on large substrates to give them specific features. The sol gel formulation is applied by electrostatic spraying to form on the surface of the inorganic hybrid organic functional layers. This process would be a very competitive alternative to current methods of dry deposition (vacuum deposition) or wet coating (dip coating) that are less productive , have capital costs and high operating costs , limited treatment feasibility of substrates of complex shape and large dimensions . The target markets are growth markets with high added value: photovoltaic modules, solar modules, functional glass, optical components, anti-corrosion layers on metallic strips etc....

Current and Potential Domains of Application	- Lubrication before metallic strip forming, stamping - Anti-corrosion layers on metallic strips - Functionalization for Optical Components (Anti reflect coatings).
Intellectual Property Rights	Secret know-how

Picture(s)





Type of partner sought	Sames Technologies would like to collaborate with companies (end users, research centers, product manufacturers such as sol gels) in order to demonstrate the assets of using its technology.
EEN Contact	**CCI de Grenoble** Elodie WAGNER elodie.wagner@grenoble.cci.fr +33 4 76 28 28 09

FRANCE SILSEF

Company

Keywords

Colors and varnish, Composite materials, Glass, Materials Processing Technology, Coatings, Steel and stainless steel, Non-ferrous Metals and Alloys, Optical Materials, Plastics, Polymers, Properties of Materials, Corrosion/Degradation, Surface treatments

Technology offer Reference: **TO_FR_010770**

Structured and functionnalised materials

Technology description

SILSEF is a technology start-up established in 2010 on the French side of Geneva to provide a commercial source of nano-structured and functionalized materials. SILSEF manufactures micro and nano-objects such as circuits for microelectronics, optics or microfluidics.
Technologies developed also make it possible to modify the surface or massic properties of materials by an appropriate nano-patterning: anti-reflecting, superhydrophobic or hydrophilic surfaces, colour engineering…
SILSEF has established a technology platform NILAB (NanoImprint Laboratory) with leading academic partners for customised solutions required by laboratories and industrial users worldwide.

Innovation features and advantages

Nano-Imprint Lithography (NIL) is a novel, low cost technology that alloys the reproduction of nano-scale patterns in volume. This enabling technology was listed by the MIT as one of the “Ten emerging technologies than can change the world” (MIT-Technology Review-2003). Originally devised as next generation lithography for semiconductor devices, the process can been tuned for a wide range of applications.

Others advantages include :

- Applicability to a large range of materials : special alloys, polymers, semiconductors (silicon, sapphire, III-V compounds...), crystals
- No chemical treatment or layer added to create surface functions
- Applicable to 2D surfaces, 2,5D and 3D under development

Current and Potential Domains of Application

Many applications have been identified such as :

- Biotechnology (hydrophobic and hydrophilic surfaces for lab on chips or diagnosis)
- Microelectronics (nano wire growth by selective area epitaxy)
- Optics (photonic crystals, filters, devices for UV and IR
- Solar (anti-reflective coating for PV cells)
- …

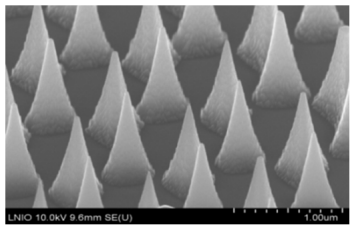
Intellectual Property Rights

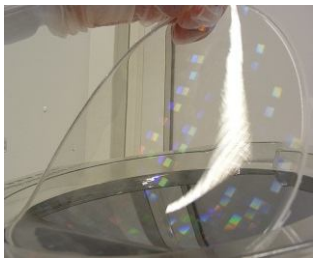
Patent(s) applied for but not yet granted
Secret know-how

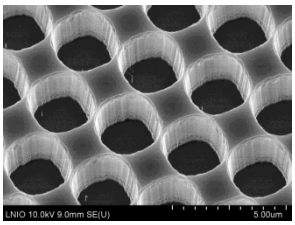
Picture(s)

NILAB

silsef







Type of partner sought	SILSEF has currently a partnership with CERN to develop photonic crystals on scintillator materials. SILSEF is looking for similar cooperation with laboratories or industrial manufacturers for custom development in other areas.
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FRANCE

VENETIX ADVANCED MATERIALS

Company

Keywords

Building materials Steel and stainless steel, Ceramic Materials and Powders, Composite materials, Materials testing

Technology & Know-How Offer Reference: **TO_FR_010171**

INNOVATIVE MATERIALS AND SHEARING TOOLS

Technology description	VENETIX ADVANCED MATERIALS is specialized in research & development in the production and sale of innovative materials and shearing tools
Innovation features and advantages	Not Documented
Current and Potential Domains of Application	Field concerning innovative materials and shearing tools Industrial machinery/processes Construction & building Research
Intellectual Property Rights	Secret know-how
Type of partner sought	NOT DETERMINED YET
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CERN

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