Kaunas University of Technology

Lithuania

Scientific Research Topics for Collaboration

Contact persons:

Assoc. prof. dr. Kristina Ukvalbergienė, kristina.ukvalbergiene@ktu.lt

Assoc. prof. dr. Brigita Abakevičienė, brigita.abakeviciene@ktu.lt

Possible topics for cooperation – micro-/nano- fabrication

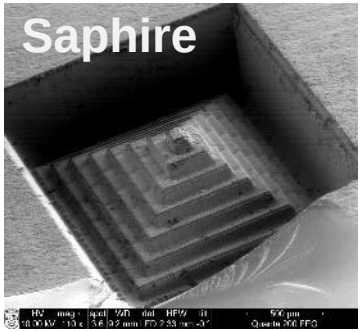
- Production of micro and (or) nanostructured thin films (surfaces) using several techniques:
  - UV lithography or electron beam lithography combined with ion beam etching or reactive ion etching
  - Imprint lithography combined with ion beam etching or reactive ion etching.
  - Direct laser microlithography
- Development of novel sensors and actuators

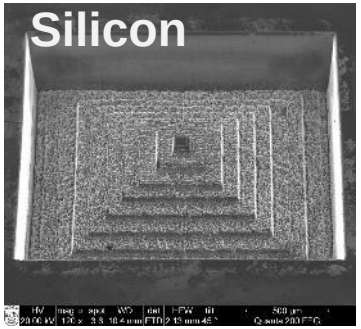
Contact person: Prof. Sigitas Tamulevičius

Sigitas.Tamulevicius@ktu.lt

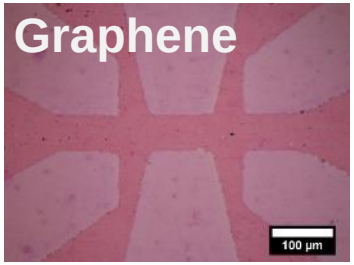
µ-Machining with a fs-Laser

Galvoscanner@1030 nm



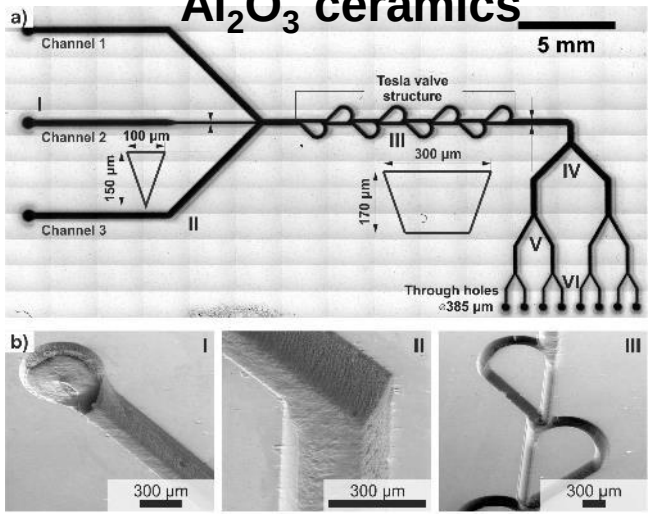


M. Barkauskas *et al.*
Ind. Laser Sol. for Man.

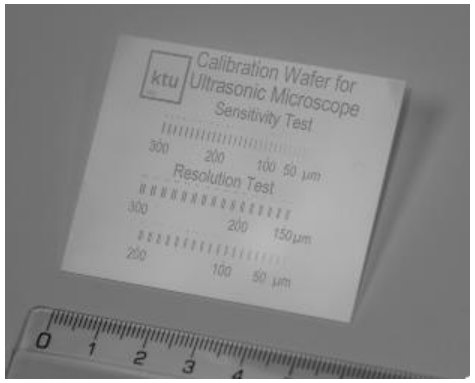


Manuscript in preparation

Al_2O_3 ceramics

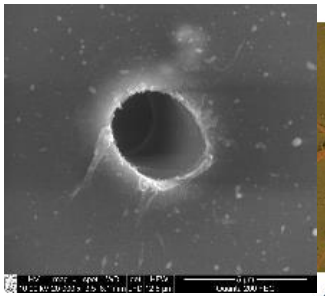


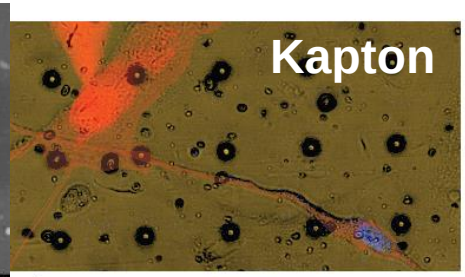
M. Juodėnas *et al.* J. Micromech. Microeng.
10.1088/1361-6439/aa84fc

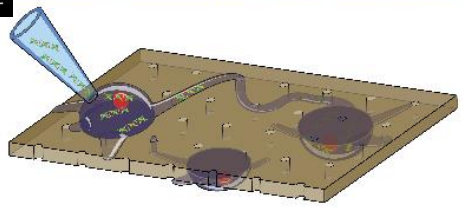


Tomas Tamulevičius *et al.* J. Microscopy 10.1093/jmicro/dfw027

Focused laser beam XYZ @515nm

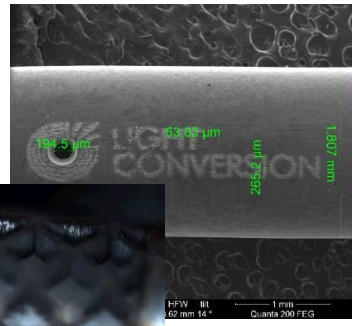


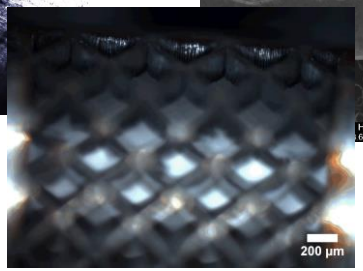




I. Antanavičiūtė *et. al* J. Tissue Eng. Regen. Med. 10.1002/term.2376

GS on curved surface@1030 nm

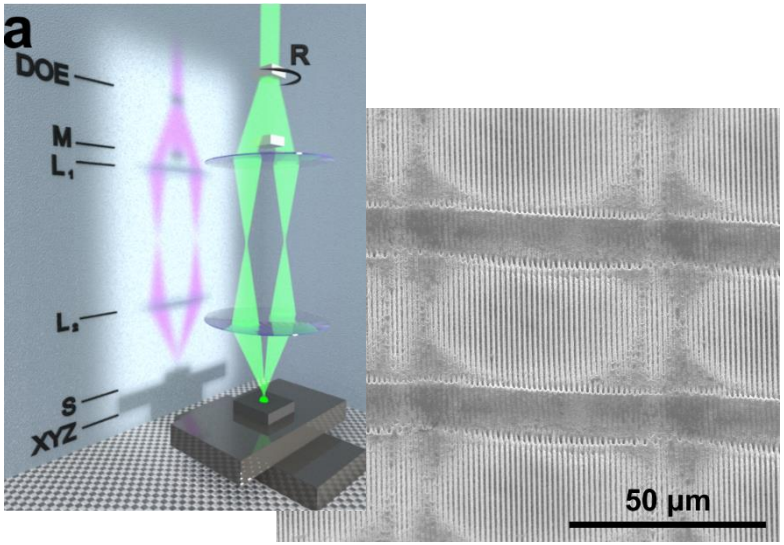




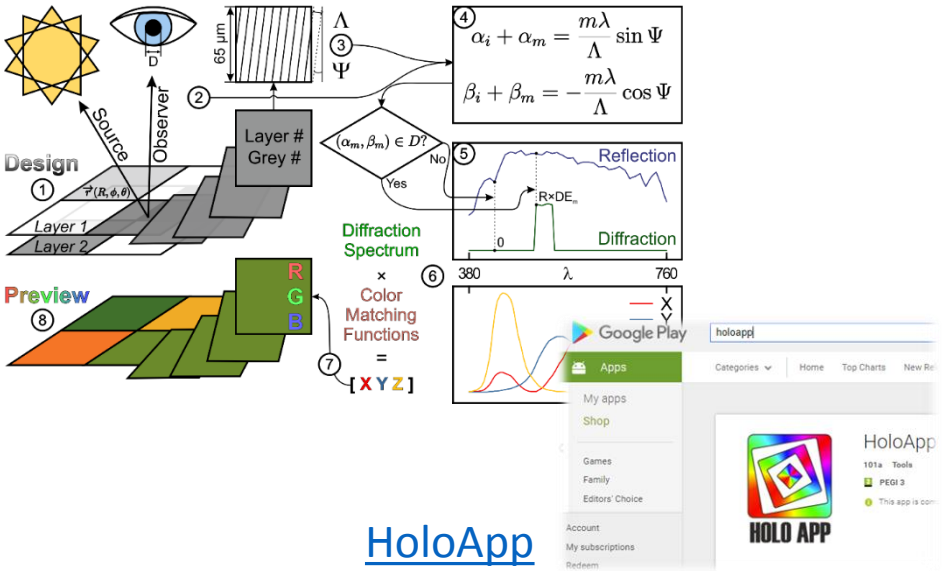
Unpublished

Holographic Security Means

Technology for originating of holograms directly on metal surface

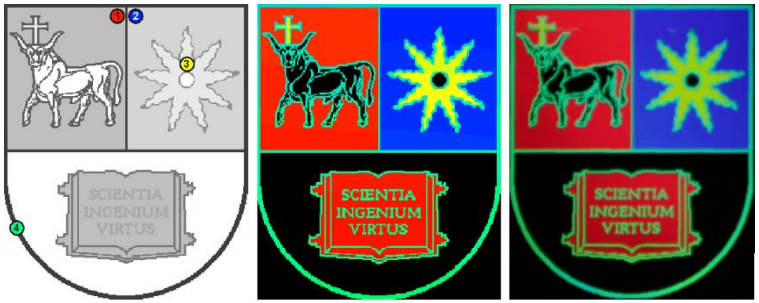


Algorithm for rendering hologram images



HoloApp

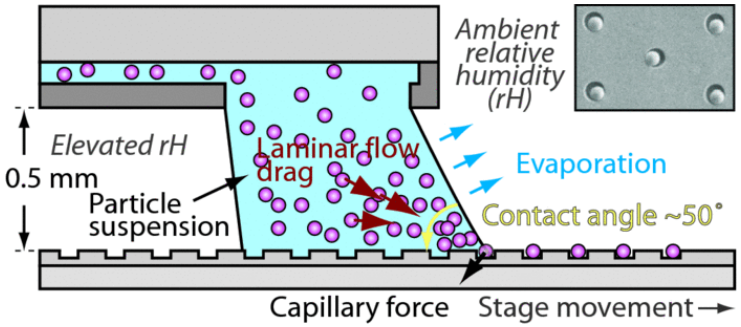
Color reconstruction



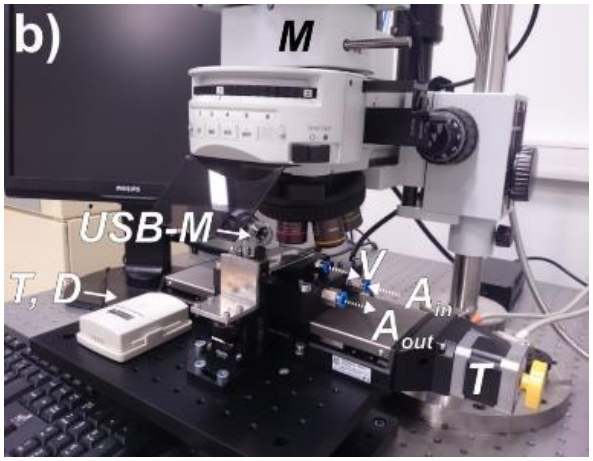
Dynamic effects and image multiplexing

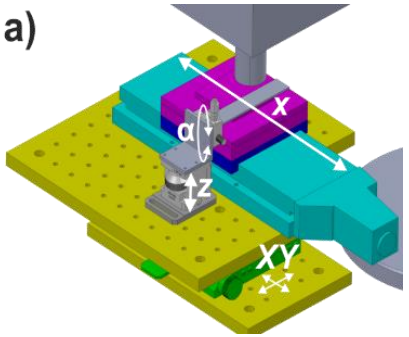
Tomas Tamulevičius *et al.* Sci Rep. 10.1038/s41598-018-32294-5

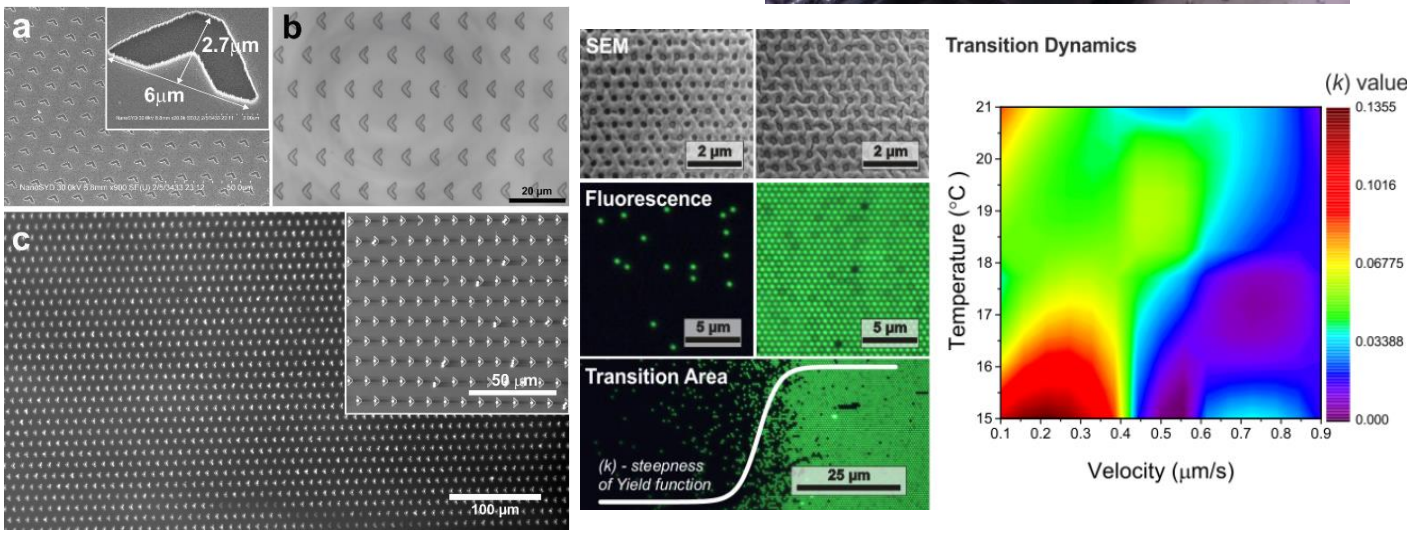
Capillarity Assisted Particle Assembly (CAPA) of μ-beads and Nanoparticels



M. J. K. Klein, et al. Rev. Sci Instr. 10.1063/1.4749846







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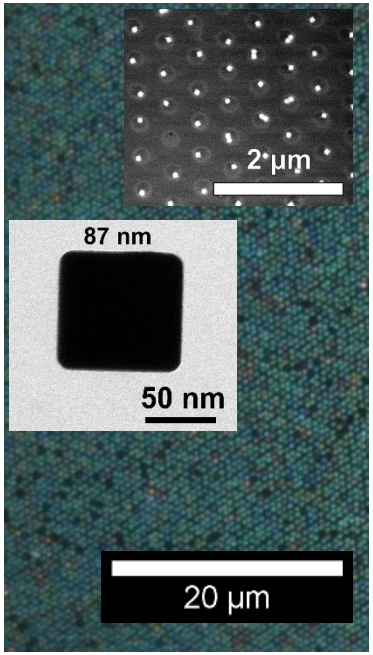
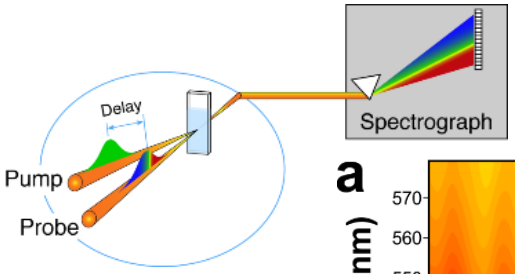
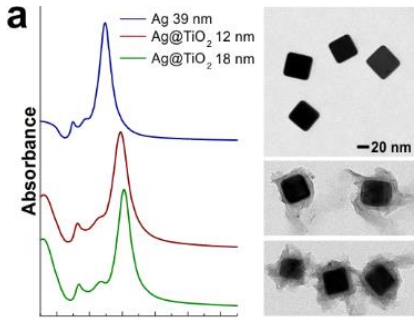


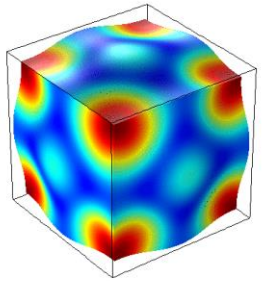
Unpublished

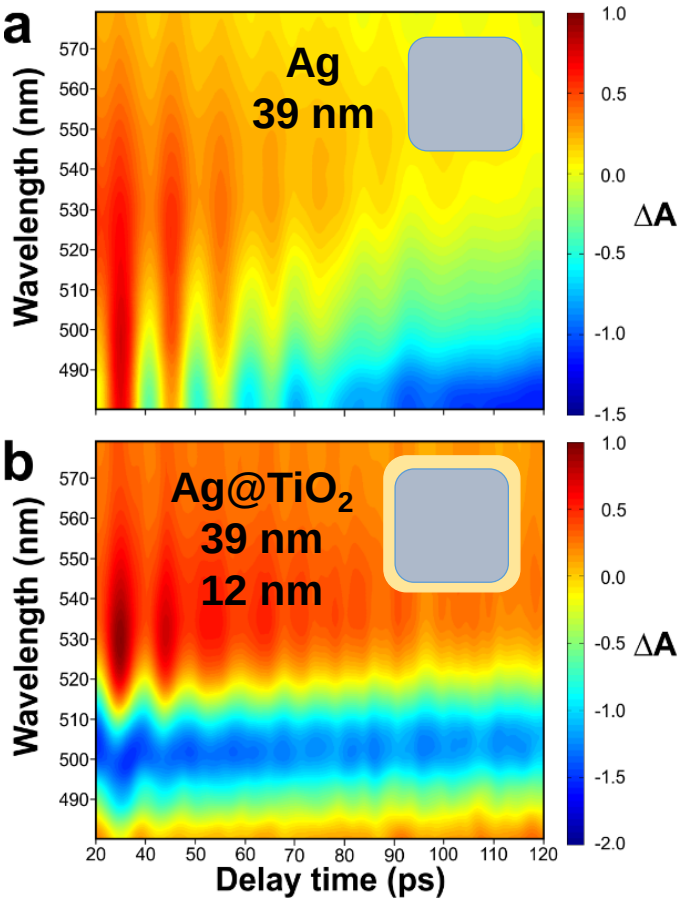
Dainius Virganavičius *et al.*, Appl. Surf. Sci., 10.1016/j.apsusc.2016.05.100

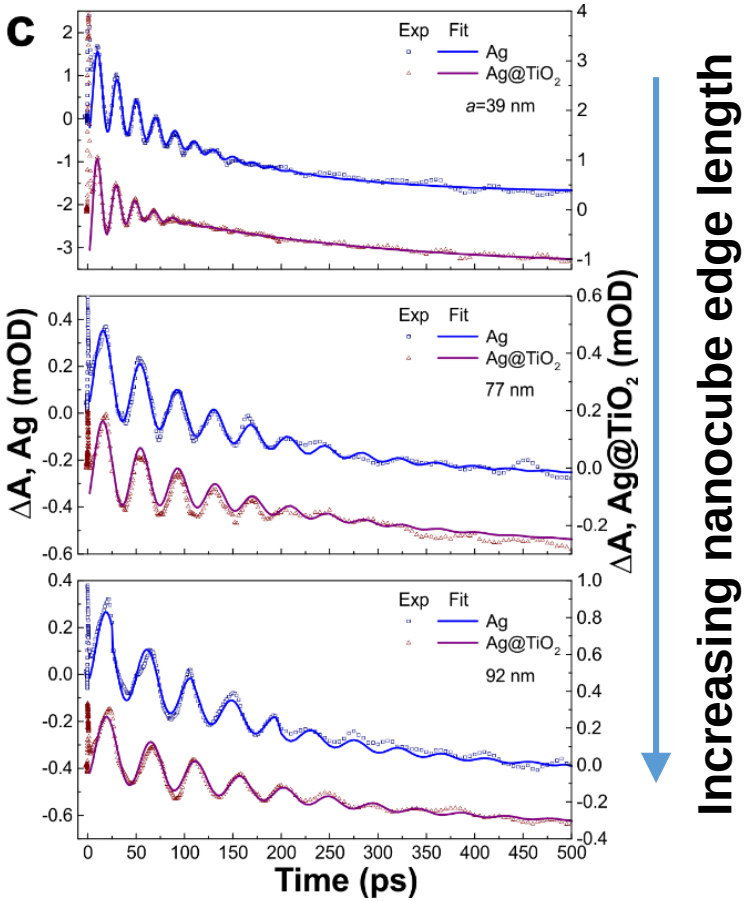
TAS for Revealing Ultra Fast Relaxation Processes in Ag Nanostructures





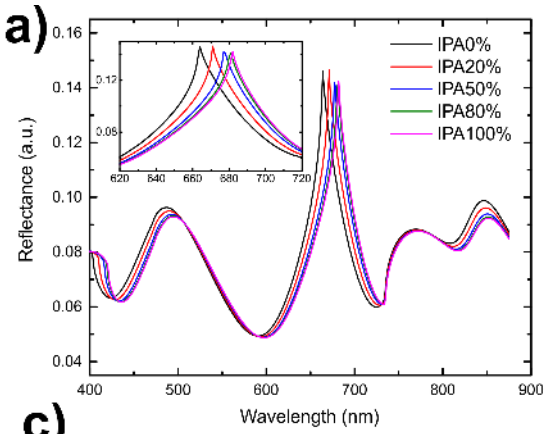


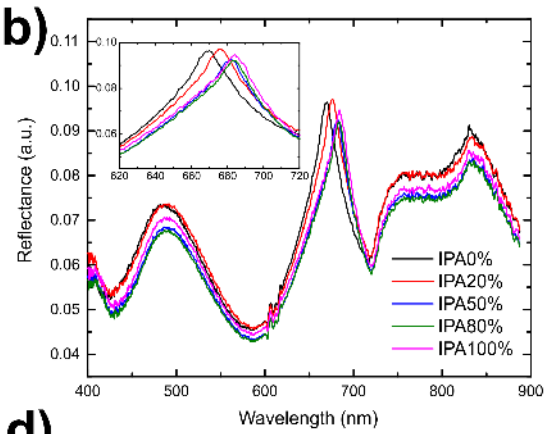


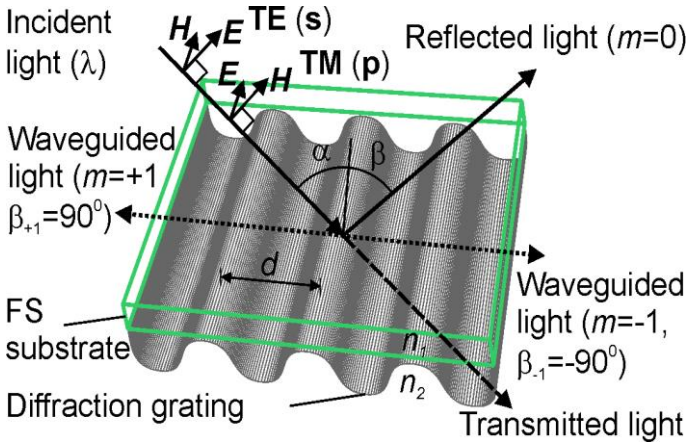


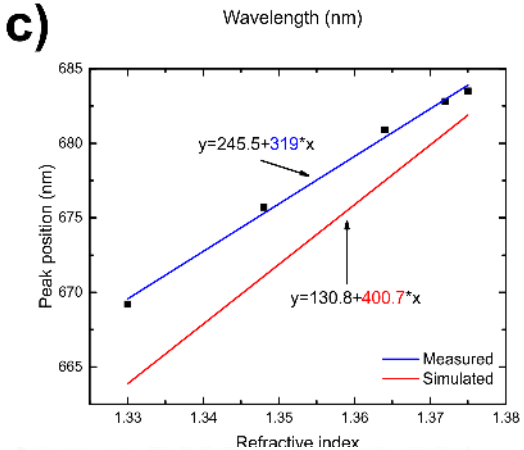
Domantas Peckus *et al.* J. Phys. Chem. C, 10.1021/acs.jpcc.7b06667

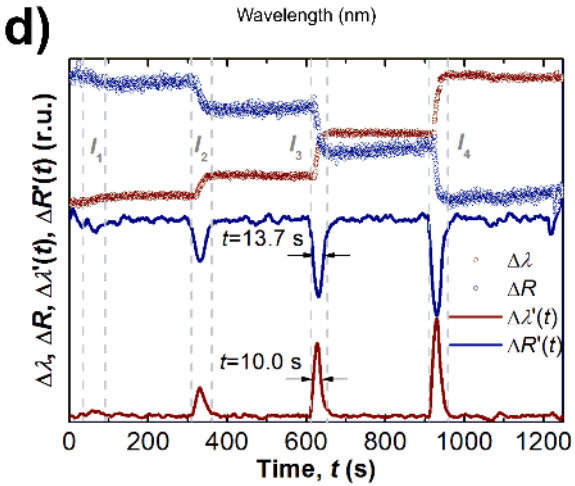
Refractive Index Sensor Chip

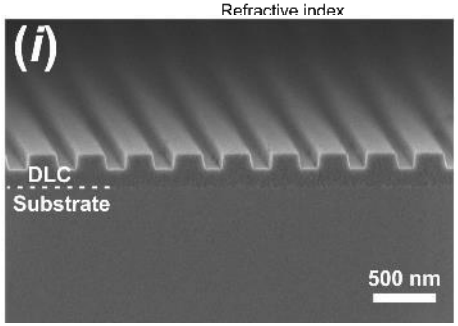


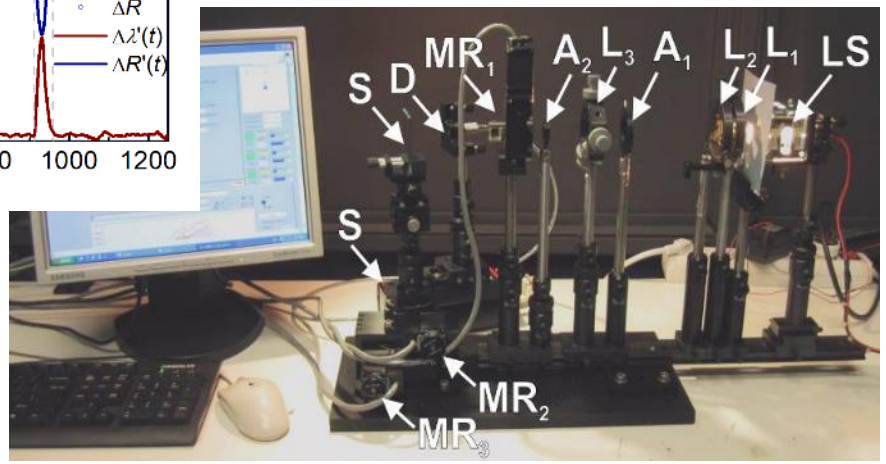












T. Tamulevičius *et al.* Thin Solid Films
10.1016/j.tsf.2011.01.099
D. Virganavičius *et al.* Appl. Surf. Sci
10.1016/j.apsusc.2016.05.100
S. Tamulevičius *et al.*
Rep. on Prog. in Phys.
10.1088/1361-6633/aa966f

Possible topics for cooperation - DLC

- Reactive magnetron sputtering deposition of DLC:Cu, DLC:Ag, DLC:Ni nanocomposite films.
  - Particularly Cu is one of the relatively low secondary electron yield materials.
  - Annealing or application of low temperature annealing during thin film deposition;
  - Deposition of hydrogen free DLC:Cu film (it need more time).
- Complete characterization of mechanical, electrical and optical properties (including Raman scattering, ESCA, pump-probe spectroscopy etc.) of carbon films and structures

Contact person: Dr. Šarūnas Meškinis

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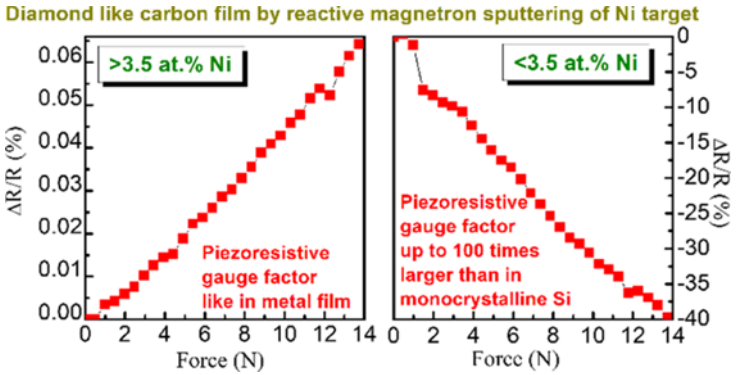
Plasma Deposited Carbon Films

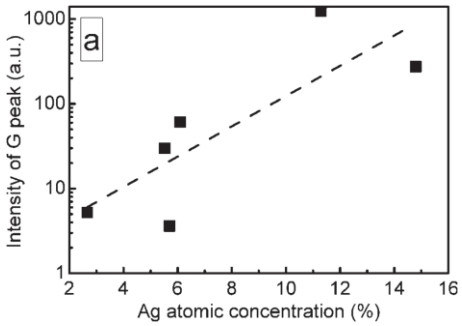
Diamond like carbon - amorphous carbon films:

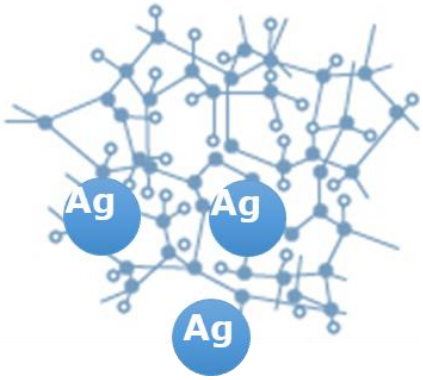
- Hydrogen free; hydrogenated; nanocomposite containing metal and/or metal nanoclusters; doped by other chemical elements (N, F etc.).
- Possible applications: low secondary electron emission surfaces (ongoing collaboration with CERN), embedded piezoresistive sensors, embedded plasmonic optical sensors, radiation and elementary particle detectors.

Graphene synthesized by microwave plasma enhanced chemical vapor deposition:

- Possible applications: low secondary electron emission surfaces; infrared detectors; radiation detectors.







Šarūnas Meškinis *et al.* ACS Appl. Mater. Interfaces 2018, 10, 15778−15785, DOI: 10.1021/acsami.7b17439
Sigitas Tamulevičius *et al*. Reports on Progress in Physics. 2018, Vol. 81, iss. 2, art. 024501, p. 1. DOI: 10.1088/1361-6633/aa966f

Medical Applications of Ionizing Radiation

Activities:

Development of dose gels & gel dosimetry methods and their application for *in vivo* dosimetry in interstitial catheter based brachytherapy, intensity modulated external radiotherapy* and proton therapy*.

Particular interest in cooperation:

Development of dose gels for dosimetry in proton therapy.

Contact person: Prof. Diana Adlienė

diana.adliene@ktu.lt

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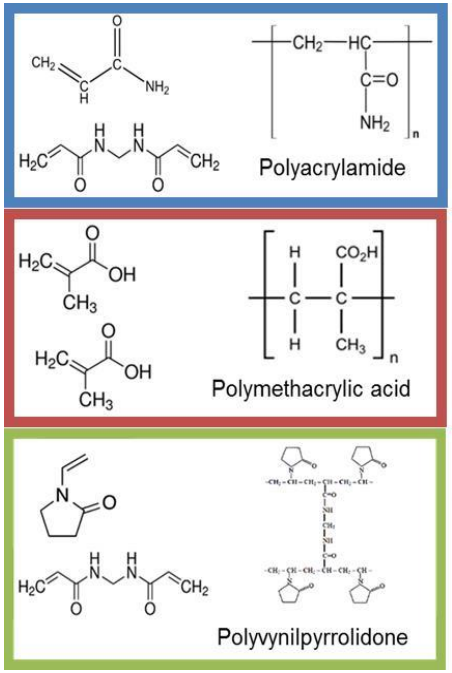
* In close collaboration with Lithuanian University of Health Sciences

* In collaboration with OncoRay Clinic at Dresden Technical University (activities just started)

Development of Dose Gels with Enhanced Sensitivity to Various Irradiation Beams

ktu 1922

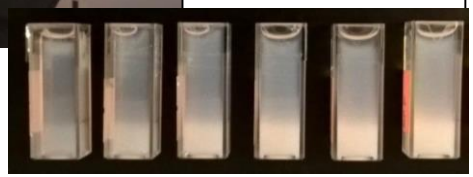
Fabrication → Irradiation → Evaluation



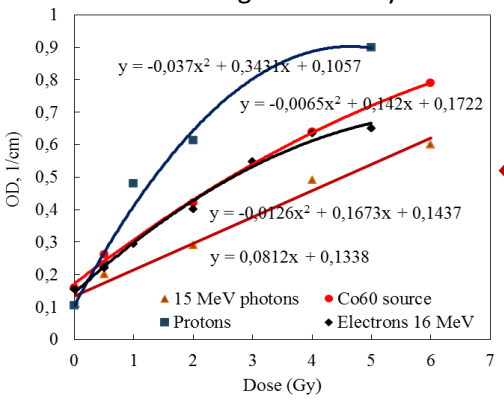
Basic constituents of dose gels	nPAG	nMAG	VIPET
Water Highly purified distilled (HPLC grade)	+	+	+
Gelatin From porcine skin (300 bloom)	+	+	+
Monomers: Acrylamide; Methacrylic acid; N-vinylpyrrolidone	+	+	+
Cross-linker N,N- methylene-bis-acrylamide	+	-	+
Oxygen scavenger Hydroxymethyl phosphonium chloride	+	+	+
Specific ingredients	+	+	+

Radiotherapy beams:

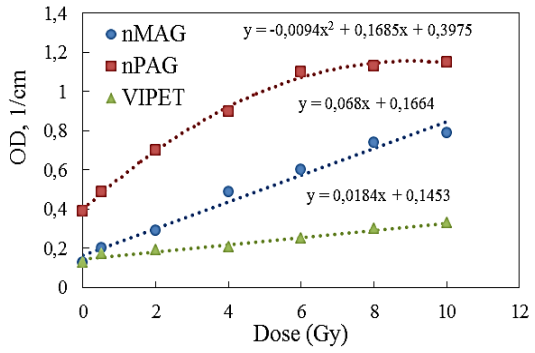
- 15 MeV photons; Gamma rays (Co-60);
- 16 MeV electrons; 230 MeV protons



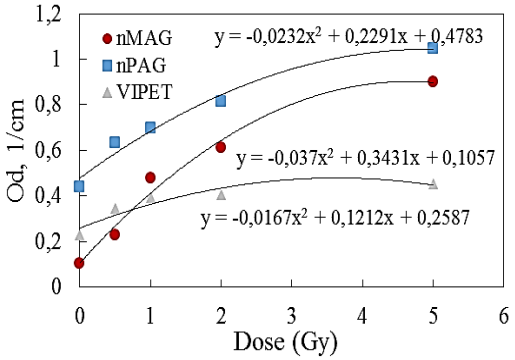
nMAG gel sensitivity



Sensitivity to 15 MeV photons



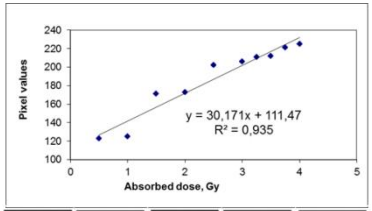
Sensitivity to 230 MeV protons

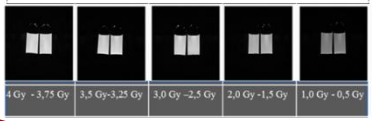


Development of New Concepts for Dose Evaluation in Irradiated Gels

ktu 1922

Currently used

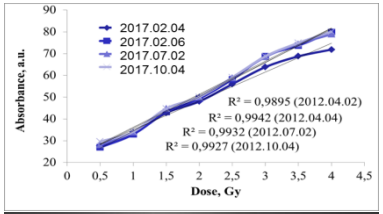




Dose calibration

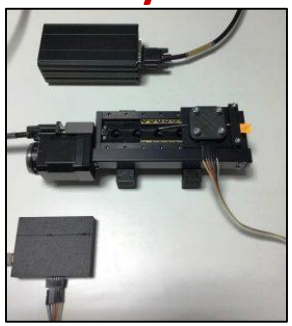
MRI

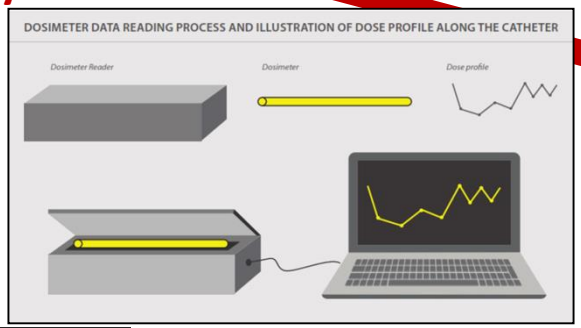
Optical method

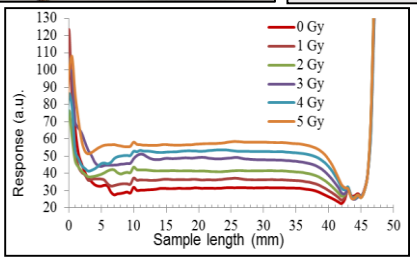


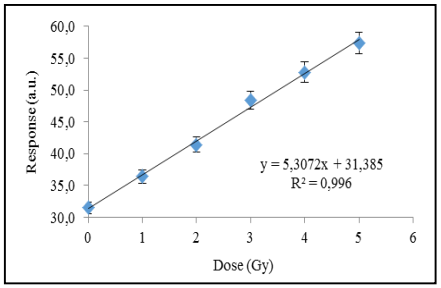
New

BrachyDose system



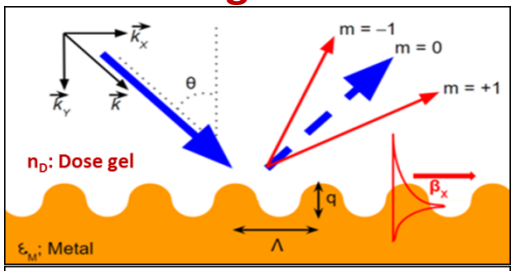




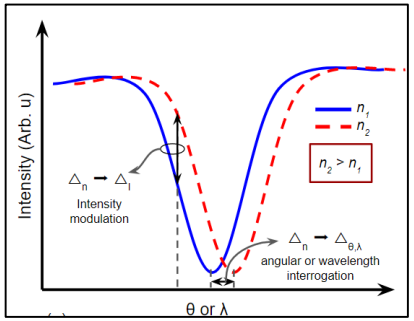


European Commission | Horizon 2020 European Union funding for Research & Innovation

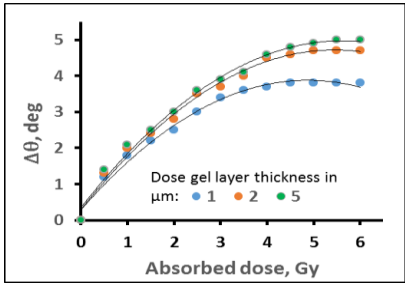
Concept of surface plasmon resonance based gel dosimeter



$$n_D \sin\theta + m\frac{\lambda}{\Lambda} = \pm \mathrm{Re}\left\{\sqrt{\frac{\varepsilon_M \varepsilon_D}{\varepsilon_M + \varepsilon_D}}\right\} + \Delta n_{ef}$$



Change of resonance angle due to radiation induced polimerization in dose gel!

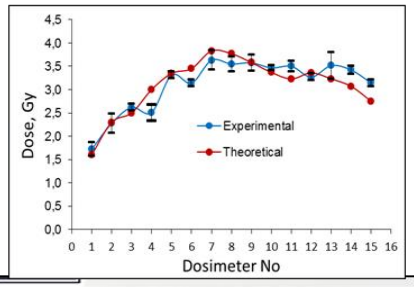


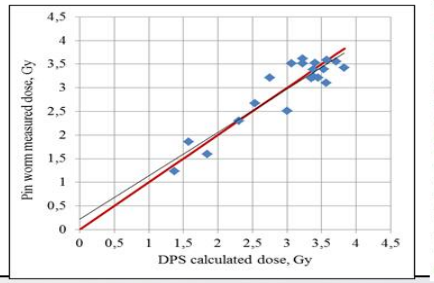
1. Urbonavičius, B.G.; Adlienė, D. Simple surface plasmon resonance-based dosemeter. RPD (2016). 169 (1-4), p 336-339.
1. Urbonavicius, B.G.; Adliene, D. In situ assessment of X-ray induced changes in polymerized gels using surface plasmon resonance detector. NIMB (2018) 435, p. 236-241.

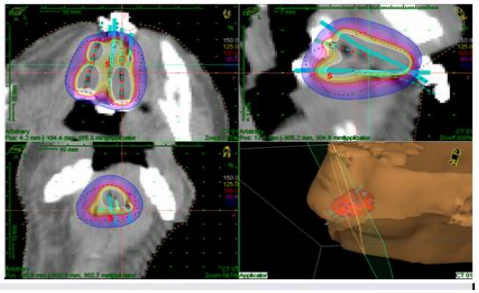
Horizon 2020-SMEINST-1-2016-2017. Phase1. Project No. 775025.
Developing a feasibility study for the future commercialization of BrachyDose - an innovative accurate and simple brachytherapy measurements tool.

In vivo Dosimetry in Catheter Based Interstitial HDR Brachytherapy

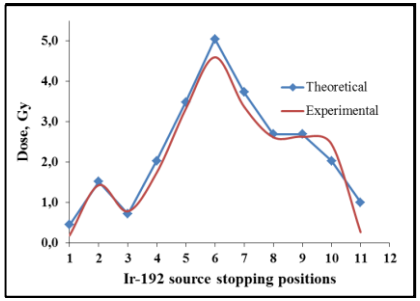
Dose measurements using **TLD (LiF:Mg, Cu, P)** pin worms (ø 0,5 mm; 2,5 mm) inserted into catheters during HDR brachytherapy procedure (^{192}Ir source)

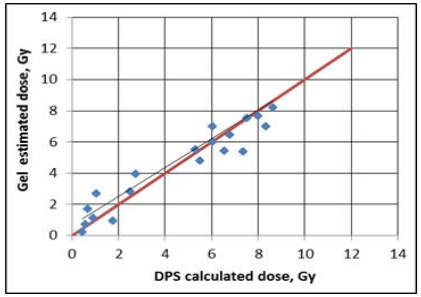


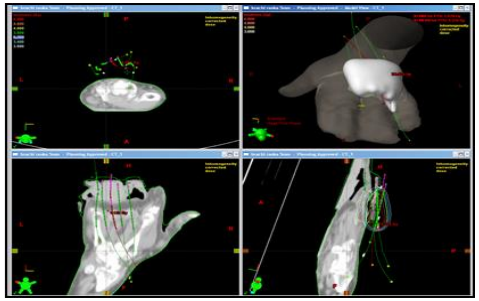




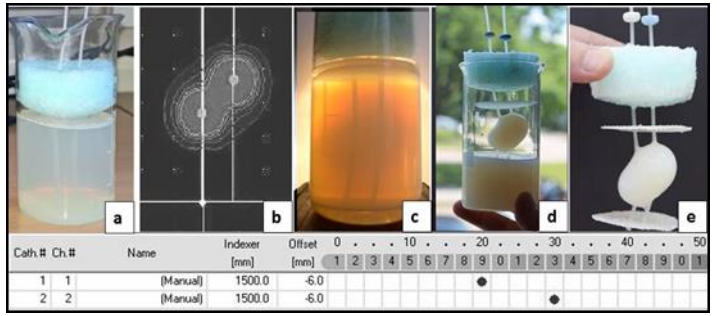
Dose measurements using **catheters filled with nPAG dose gel** during HDR brachytherapy procedure







Concept of ionzing radiation based 3D printing: Free standing dose gels for simulation of irradiated tumor shapes



Adlienė, D. et al. First approach to ionizing radiation based 3D printing: fabrication of free standing dose gels using high energy gamma photons. NIMB (2018) 435, p. 246-250.

Jaselskė, E. et al. In vivo dose verification method in catheter based high dose rate brachytherapy. Physica Medica (2017) 44, p. 1-10.

Adlienė, D. et al. In vivo TLD dose measurements in catheter-based high-dose-rate brachytherapy. RPD (2015) 165 (1-4) p. 477-481.

Areas of Collaboration in Applied Mathematics

- Data Mining
  - Statistics, data mining, machine learning and predictive modeling
- Machine Learning Modelling
  - Mining functional dependencies from data
  - Models for (Big) Data applied to control and monitoring environment

Areas of Collaboration in Applied Mathematics

- Mathematical analysis of dynamic systems
- Mathematical modelling
- Signals and time series analysis
- Multivariate data analysis and visualization
- Reliability theory applications
- Stochastic modelling using Markov processes