PROJECTS

2018

INTERNATIONAL

1. **Republic of Lithuania Ministry of Education and Science, Republic of China (Taiwan) National Research Council and Republic of Latvia Ministry of Education and Science collaboration project „2D nanostructures of noble metal nanoparticles for biosensos application“, project leader dr. Sigitas Tamulevičius (2018-2020)**

In this project capillary force assisted particle assembly will be produced and studied for applications including Surface Enhanced Raman Spectroscopy (SERS), elastic scattering and photoluminescence for biosensing. The project will aim at the developing of effective nanostructured templates, production of regular noble metal nanoparticle arrays, design and synthesis of proper peptide biomarker based on the proteomic profile of tear, as well as construction of SERS, luminescence, absorption and elastic scattering based biosensor for diagnosis of ocular surface and systemic diseases. The metal nanoparticle array templates as biosensors for detection and quantification of the biomarkers, such as infective microbes, protein or non-protein biomarkers, as well as the cancerous cells will be employed.
The formed structures are expected to be sensitive enough to analyze the biomarkers from human tears. This would open up new approach for noninvasive monitoring of diseases from simple teardrop

2. **Project of the European Commission Research Executive Agency H2020MCRA RICE 2017 „Physical principles of the creation of novel SPINtronic materials on the baseof MULTIlayered metal-oxide FILMs for magnetic sensors and MRAM“, project leader dr. Sigitas Tamulevičius (2018-2021)**

The main goal of the project is the elaboration of research and development principles and technology, as well as creation of novel nanoheterostructures for application in spintronic devices, first of all, in magnetic field sensors and magnetoresistive random access memories. The key research and technological aspects are focused on the formation of layers and/or nanosized grains of a ferromagnetic material with an ultimate degree of conduction electron spin polarization, separated by dielectric interlayers.
The project aims as well at the creation of a stimulating and interdisciplinary training partnership, with actors from the academia and private sector, promoting the exchange of ideas, methods, techniques as well as enabling an accelerated technology transfer from science to industry through a continuous collaboration between the stakeholders. Training of the high-level personnel possessing complementary interdisciplinary skills is thus a key issue.

NATIONAL

1. **Project of the Lithuanian Research Council program Improvement of researchers' qualification by implementing world-class R&D projects "Development of advanced self-healing composites for new generation touch-sensitive screens", project leader dr. Algirdas Lazauskas (2018-2021)**

This project is aimed to improve touch-sensitive screen technology via development of flexible, optically transparent, electrically conductive and self-healing multilayered composite, which would replace ITO coated glass. The first layer would consist of electrically conductive polymer with conjugated double bonds while the second layer - an optically transparent polymer with self-healing function. The surface of the second layer (outer layer) would be coated with a thin film exhibiting

superhydrophobic and superoleophobic properties. The use of suggested composite would ensure the mobile device flexibility, regeneration of the screen and significantly enhance the impact resistance. Additionally, it would allow to eliminate complex and expensive ITO coating formation processes.

2. **Project of the Lithuanian Research Council program Improvement of researchers' qualification by implementing world-class R&D projects "Heterostructures and Superlattices of the Graphene and Related Carbon 2D Nanomaterials for Photovoltaics", project leader dr. Šarūnas Meškinis (2018-2021).**

The proposed project is related to the development of the new nanomaterial synthesis technologies. That is a direct synthesis of the doped graphene and graphene superlattices on the semiconductor substrates by vacuum and plasma methods. Structure, chemical composition, optical, electrical and photovoltaic properties will be studied. Possibility to apply newly developed nanomaterials for fabrication of the higher efficiency solar cells will be considered.

3. **This project „Creation and Development of innovative optical security devices and next generation micro/nano devices and structures for optical applications" (01.2.2-CPVA-K-703-02-0014) is funded by the European Regional Development Fund according to the 2014–2020 Operational Programme for the European Union Funds' programme priority "Strengthening Research and Development and Innovation" activity "Strengthening of Activities of Competence Centres' and Innovation and Technology Transfer centers' " under measure No. 01.2.2-CPVA-K-703; project leader dr. Sigitas Tamulevičius (2018-2021)**

It is planned to carry out systematic research ensuring the verification of commercially-available concepts, the development of micro-technologies and the development and implementation of innovative products. During the project the following activities will be carried out: originals of special security means by integration of digital holograms using method of continuous wave and pulsed laser radiation; nano texts and direct hologram image formation on the surface of materials; the application of local ultra-short laser pulse effects for the formation of micro-images by local manipulation of the optical properties of capillary deposited precisely arranged nano / microparticles; investigation of diffraction optical elements and microfluidic devices for optical applications; the application of laser interference and electron beam lithography for the development and implementation of new security means.

4. European Social Fund under the measure No 09.3.3- LMT-K-712 „Development of Competences of Scientists, researchers, other Researchers and Students through Practical Research Activities" funded project „Overview of Applications for the Kelvin Probe Force Microscopy Method", Nr. 09.3.3-LMT-K-712-09-0079, supervisor – assoc.prof. dr. Asta Guobienė (2018)..

5. European Social Fund under the measure No 09.3.3- LMT-K-712 „Development of Competences of Scientists, researchers, other Researchers and Students through Practical Research Activities" funded project No. 09.3.3-LMT-K-712-09-0045, supervisor – Senior Researcher, dr. Šarūnas Meškinis (2018).

6. European Social Fund under the measure No 09.3.3- LMT-K-712 „Development of Competences of Scientists, researchers, other Researchers and Students through Practical Research Activities“ funded project “Investigation of different geometry silver nanoparticles for SERS sensors”, No. 09.3.3-LMT-K-712-09-0058; supervisor – Assoc. Prof. dr. Asta Tamulevičienė (2018)

7. European Social Fund under the measure No 09.3.3- LMT-K-712 „Development of Competences of Scientists, researchers, other Researchers and Students through Practical Research Activities“ funded project “Modeling of microstructures for optical applications“, No. 09.3.3-LMT-K-712-09-0053, supervisor – Prof. dr. Tomas Tamulevičius (2018)

8. European Social Fund under the measure No 09.3.3- LMT-K-712 „Development of Competences of Scientists, researchers, other Researchers and Students through Practical Research Activities“ funded project “Investigation of materials and structures used for capillary assisted deposition of nanoparticles”, No. 09.3.3-LMT-K-712-09-0054, supervisor – Prof. dr. habil. Sigitas Tamulevičius (2018).

9. European Social Fund under the measure No 09.3.3- LMT-K-712 „Development of Competences of Scientists, researchers, other Researchers and Students through Practical Research Activities“ funded project “Formation of porous anodic aluminum oxide and structural investigations with X-ray diffraction”, No. 09.3.3-LMT-K-712-09-0077, supervisor – Assoc. Prof., dr. Brigita Abakevičienė (2018).

Self-supporting projects

1. **Interreg BSR program project „Transnational Research Access in Macro-Region – Baltic TRAM" (project No.: R002) “Development of Advanced Optical Security Device”, Contract No.: 18-01/1, project leader dr. Viktoras Grigaliūnas (2018).**

This project presents an advanced optical security device created by combining the dot-matrix and electron beam lithography techniques in a single master image. Patterning of holopixels arranged with different grating orientations and pitches was done using a dot-matrix master shooting machine equiped with a laser diode PMMF 608-G operating at a wavelength of 405 nm. For the patterning of nanotext and diffraction gratings in the specified areas of the same sample we have used Raith eLiNEplus high resolution electron beam lithography and ultra high resolution imaging & analysis system. The ratio of areas patterned by dot-matrix technique and e-beam lithography is about 16:1, thus relatively more expensive and slower e-beam writing time was not very large to form a combined image. The layout of combined image was investigated by optical, scanning electron and atomic force microscope. It was shown, that e-beam patterned gratings have smooth and steady edges, while the slopes and the ridge surface of the dot-matrix patterned gratings are inclined and uneven. Measurements showed differences in spatial frequency and shape of the grooves as well as profile depth between the e-beam and dot-matrix patterned gratings. This differences can be easily

recognized at the expert level, thus providing a very high security degree and preventing counterfeiters..