2013

National projects

- **"Extraordinary Piezoresistance Diamond Like Carbon Nanocomposites and Micro-(Nano-) Structures"** (PJEZODEIMA) (2013‑2015), funded by Research Council of Lithuania .

The aim of this study is deposition, investigation and application for strain gages of the large GF and zero TCR DLC and DLC nanocomposite films. Research on GF and TCR of ta-C films as well as ta-C and metal nanocomposites grown by novel deposition method – high power pulse magnetron sputtering - was planned. The influence of the sp3/sp2 C bond ratio, hydrogen, dimensions of the clusters, metal type was investigated. In addition, principles of the extraordinary piezoresistance metamaterial as well as geometric effects were applied for further increase of GF.

Publications:

• Meškinis, Šarūnas; Vasiliauskas, Andrius; Šlapikas, Kęstutis; Niaura, Gediminas; Juškėnas, Remigijus; Andrulevičius, Mindaugas; Tamulevičius, Sigitas. Structure of the silver containing diamond like carbon films: Study by multiwavelength Raman spectroscopy and XRD // Diamond and related materials. Lausanne: Elsevier Science. ISSN 0925-9635. 2013, vol. 40, p. 32-37. [IF (SCIE): 1,572 (2013)].

• Meškinis, Šarūnas; Vasiliauskas, Andrius; Šlapikas, Kęstutis; Gudaitis, Rimantas; Andrulevičius, Mindaugas; Čiegis, Arvydas; Niaura, Gediminas; Kondrotas, Rokas; Tamulevičius, Sigitas. Bias effects on structure and piezoresistive properties of DLC: Ag thin films // Surface & coatings technology. Lausanne: Elsevier Science. ISSN 0257-8972. 2014, Vol. 255, p. 84-89. [IF (SCIE): 1,998 (2014)].

• Meškinis, Šarūnas; Gudaitis, Rimantas; Vasiliauskas, Andrius; Čiegis, Arvydas; Šlapikas, Kęstutis; Tamulevičius, Tomas; Andrulevičius, Mindaugas; Tamulevičius, Sigitas. Piezoresistive properties of diamond like carbon films containing copper // Diamond and related materials. Lausanne: Elsevier Science. ISSN 0925-9635. 2015, vol. 60, p. 20-25. [Science Citation Index Expanded (Web of Science); Academic Search Premier; Chemical Abstracts (CAplus); Compendex; Inspec; Science Direct]. [IF (SCIE): 1,919 (2014)].

- **"Fundamental Research of Surface Relief and Molecular Forces Influence on the Self-Organization of Nanoparticles and Training of International Competitiveness of Researchers Working in this Field"** (PARMO) (2013‑2015), ESFA, No. VP1-3.1-ŠMM-10-V-02-028)

The equipment and method for capillary assisted deposition of nanosized objects on templates was designed, templates for deposition of nanosized objects were formed.

Publications:

• Tamulevičienė, Asta; Kopustinskas, Vitoldas; Niaura, Gediminas; Meškinis, Šarūnas; Tamulevičius, Sigitas. Multiwavelength Raman analysis of SiO_x and N containing amorphous diamond like carbon films // Thin solid films. Lausanne: Elsevier. ISSN 0040-6090. 2015, vol. 581, p. 86-91. [Science Citation Index Expanded (Web of Science); Science Direct]. [IF (SCIE): 1,759 (2014)].

• Lazauskas, Algirdas; Baltrušaitis, Jonas; Grigaliūnas, Viktoras; Guobienė, Asta; Prosyčevas, Igoris; Narmontas, Pranas; Abakevičienė, Brigita; Tamulevičius, Sigitas. Thermally-driven structural changes of graphene oxide multilayer films deposited on glass substrate // Superlattices and microstructures. London: Academic Press-Elsevier Science. ISSN 0749-6036. 2014, Vol. 75, p. 461-467. [Science Citation Index Expanded (Web of Science); Chemical Abstracts (CAplus); Compendex; Inspec; Science Direct]. [IF (SCIE): 2,097 (2014)].

• Virganavičius, Dainius; Šimatonis, Linas; Jurkevičiūtė, Aušrinė; Tamulevičius, Tomas; Tamulevičius, Sigitas // Formation of sub-wavelength pitch regular structures employing a motorized multiple exposure Lloyd's mirror holographic lithography setup // Proc. SPIE 9170, Nanoengineering: Fabrication, Properties, Optics, and Devices XI, 91701I (August 28, 2014); doi:10.1117/12.2061191

- **"Creation of Biological Cardiostimulator Involving Foreign Science and Study Institutions and Improvement Competencies of Researchers and Other Employees"** (BIOKARDIOSTIM) (2013‑2015), ESFA (No. VP1-3.1-ŠMM-10-V-02-029).

The project was carried out with partners from Lithuanian University of Health Sciences and The Centre for Innovative Medicine. The review about biocompatible materials in which microscaffolds devoted for stopping stem cell migration from heart can be formed employing laser microfabrication and laser microfabrication experiments were performed.

Publications:

• Tamulevičius, Tomas; Šimatonis, Linas; Ulčinas, Orestas; Gadeikytė, Aušra; Abakevičienė, Brigita; Tamulevičius, Sigitas; Antanavičiūtė, Ieva; Mikalayeva, Valeryia; Skeberdis, Vytenis Arvydas; Stankevičius, Edgaras. Femtosecond laser micro machined polyimide films for cell scaffold // Journal of Tissue Engineering and Regenerative Medicine (2016) (submitted)

• Adomavičiūtė, Erika; Tamulevičius, Tomas; Šimatonis, Linas; Fataraitė-Urbonienė, Eglė; Stankevičius, Edgaras; Tamulevičius, Sigitas. Microstructuring of Electrospun Mats Employing Femtosecond Laser // Materials Science (Medžiagotyra) 2015, Vol. 21, No. 1, pp. 44 – 51. (http://www.matsc.ktu.lt/index.php/MatSc/article/view/10249)

• Tamulevičius, Tomas; Gadeikytė, Aušra; Augulis, Liudvikas; Tamulevičienė, Asta; Fataraitė, Eglė; Tamulevičius, Sigitas. Microstructuring and mechanical testing of biocompatible polymers for biological applications // Radiation interaction with materials: fundamentals and applications 2014: 5th International conference, Kaunas, Lithuania, May 12-15, 2014: program and materials / Kaunas University of Technology, Vytautas Magnus University, Lithuanian Energy Institute, Riga Technical University, Hydrogen Energy Association. Kaunas: Technologija. ISSN 2351-583X. 2014, p. 187-189.

• Mikalayeva, Valeryia; Antanavičiūtė, Ieva; Tamulevičius, Tomas; Stankevičius, Edgaras. Application of polyimide films for cell scaffold in tissue engineering // Acta Physiologica: Special Issue: Abstracts from the Joint Meeting of the Federation of European Physiological Societies and the Baltic Physiological Societies: Kaunas, Lithuania, 26-29 August 2015: abstracts / Federation of European Physiological Societies. Lithuanian Physiological Society [et al.]. Hoboken: Wiley-Blackwell. ISSN 1748-1716. 2015, Vol. 215, suppl. SI705, p. 137. [Science Citation Index Expanded (Web of Science)].

- **"Regular 3D Structures for Optical Sensors" (3Dsens)** (2013‑2015), researcher team project of Research Council of Lithuania

The project aims at the development of new flexible and high throughput two and three dimensional periodic submicron and nanometre range structure formation method based on application of feasible materials and new automated holographic lithography optical scheme. The fabricated regular structures will be applied for the development of novel optical refractive index sensors relevant for monitoring of the chemical or biological processes taking part in liquids.

Publications:

• Yaremchuk, Iryna; Tamulevičienė, Asta; Tamulevičius, Tomas; Šlapikas, Kęstutis; Balevičius, Zigmas; Tamulevičius, Sigitas. Modeling of the plasmonic properties of DLC-Ag nanocomposite films // Physica status solidi A: Applications and materials science. Weinheim: Wiley. ISSN 1862-6300. 2014, Vol. 211, no. 2, p. 329-335. [Science Citation Index Expanded (Web of Science)]. [IF (SCIE): 1,616 (2014)].

• Yaremchuk, Iryna; Tamulevičius, Tomas; Fitio, Volodymyr; Gražulevičiūtė, Ieva; Bobitski, Yaroslav; Tamulevičius, Sigitas. Numerical implementation of the S-matrix algorithm for modeling of relief diffraction gratings // Journal of modern optics. Abingdon: Taylor & Francis. ISSN 0950-0340. 2013, vol. 60, iss. 20, p. 1781-1788. [Science Citation Index Expanded (Web of Science)]. [IF (SCIE): 1,166 (2013)].

• Tamulevičius, Tomas; Gražulevičiūtė, Ieva; Urbonas, Darius; Gabalis, Martynas; Petruškevičius, Raimondas; Tamulevičius, Sigitas. Numerical and experimental analysis of optical response of sub-wavelength period structure in carbonaceous film for refractive index sensing // Optics Express, Vol. 22, Issue 22, pp. 27462-27475 (2014) [IF (E): 3,525 (2013)]

- **"Plasmonic Nanostructures for Solar Cells with Decreased Spectrum Losses" (NIRSOLIS)** (2013‑2015), Global Grant project funded by Research Council of Lithuania .

The structure, composition and optical properties of DLC:Cu and DLC:Ag films were investigated. Photovoltaic properties of DLC:Cu and DLC:Ag heterostructures were studied. UV irradiation effects on optical properties of DLC:Ag films were investigated.

Publications:

- Š. Meškinis, A. Čiegis, A. Vasiliauskas, A. Tamulevičienė, K. Šlapikas, R. Juškėnas, G. Niaura, S. Tamulevičius. Plasmonic properties of silver nanoparticles embedded in diamond like carbon films: Influence of structure and composition // Applied Surface Science, Volume 317, 30 October 2014, Pages 1041-1046. http://www.sciencedirect.com/science/article/pii/S0169433214020108 (IF 3.15; Nr. 1 WoS - MATERIALS SCIENCE, COATINGS & FILMS, Q1 WoS grupėje PHYSICS, APPLIED).
- Š. Meškinis, A. Čiegis, A. Vasiliauskas, K. Šlapikas, T. Tamulevičius, A. Tamulevičienė, S. Tamulevičius. Optical properties of diamond like carbon films containing copper, grown by high power pulsed magnetron sputtering and direct current magnetron sputtering: Structure and composition effects // Thin Solid Films, Volume 581, 30 April 2015, Pages 48‑53. http://www.sciencedirect.com/science/article/pii/S0040609014011651 (IF 1.759; Nr. 6 WoS - MATERIALS SCIENCE, COATINGS & FILMS, Q2 WoS - PHYSICS, APPLIED and MATERIALS SCIENCE, MULTIDISCIPLINARY).
- Yaremchuk, Š. Meškinis, V. Fitio, Ya. Bobitski, K. Šlapikas, A. Čiegis, Z. Balevičius, A. Sielskis, S.Tamulevičius. Spectroellipsometric characterization and modelling of plasmonic diamond like carbon nanocomposite films with embedded Ag nanoparticles //

Nanoscale Research Letters, (2015) 10:157. http://www.nanoscalereslett.com/content/10/1/157 (IF 2.584; Q1 WoS sąrašo tematikų grupėje PHYSICS, APPLIED)

- Š. Meškinis, A. Čiegis, A. Vasiliauskas, K. Šlapikas, T. Tamulevičius, M. Andrulevičius, G. Niaura, S. Tamulevičius. Effects of the deposition conditions on structure and properties of DLC:Cu films deposited by HIPIMS and DC magnetron sputtering // Journal of Nanoscience and Nanotechnology, Vol. 16, 2016, 10133‑10142. (IF 1.556; Q2 WoS - CHEMISTRY, MULTIDISCIPLINARY)
- Š. Meškinis, T. Tamulevičius, G. Niaura, K. Šlapikas, A. Vasiliauskas, O. Ulčinas, S. Tamulevičius. Surface enhanced Raman scattering effect in diamond like carbon films containing Ag nanoparticles // Journal of Nanoscience and Nanotechnology, Vol. 16, 2016, 10143‑10151. (IF 1.556; Q2 WoS - CHEMISTRY, MULTIDISCIPLINARY)
- D. Peckus, T. Tamulevičius, Š. Meškinis, A. Tamulevičienė, A. Vasiliauskas, O. Ulčinas, V. Gulbinas, S. Tamulevičius. Linear and Nonlinear Absorption Properties of Diamond Like Carbon Doped With Cu Nanoparticles // Plasmonics, 2017, Volume 12, Issue 1, pp 47‑58. http://link.springer.com/article/10.1007/s11468-016-0227-0 (IF 2.146; Q2 WoS - MATERIALS SCIENCE, MULTIDISCIPLINARY)
- Š. Meškinis, Arvydas Čiegis, Andrius Vasiliauskas, KęstutisŠlapikas, Rimantas Gudaitis, Iryna Yaremchuk, Volodymyr Fitio, Yaroslav Bobitski, Sigitas Tamulevičius. Annealing Effects on Structure and Optical Properties of Diamond-Like Carbon Films Containing Silver, Nanoscale Research Letters (2016) 11:146. https://nanoscalereslett.springeropen.com/articles/10.1186/s11671-016-1362-4 (IF 2.584; Q1 WoS - PHYSICS, APPLIED).
- Š. Meškinis, D. Peckus, A. Vasiliauskas, A. Čiegis, R. Gudaitis, T. Tamulevičius, I. Yaremchuk, S. Tamulevičius. Photovoltaic Properties and Ultrafast Plasmon Relaxation Dynamics of DiamondLike Carbon Nanocomposite Films with Embedded Ag Nanoparticles. Nanoscale Research Letters (2017) 12:288. https://nanoscalereslett.springeropen.com/articles/10.1186/s11671-017-2065-1 (IF 2.584; Q1 WoS - PHYSICS, APPLIED).
- Jurkevičiūtė, A. Lazauskas, T. Tamulevičius, A. Vasiliauskas, D. Peckus, Š. Meškinis, S. Tamulevičius. Structure and density profile of diamond-like carbon films containing copper: Study by X-ray reflectivity, transmission electron microscopy, and spectroscopic ellipsometry. Thin Solid Films, Volume 630, 30 May 2017, Pages 48-58. http://www.sciencedirect.com/science/article/pii/S0040609016306022
- Arvydas Čiegis, Vitoldas Kopustinskas, Šarūnas Meškinis, Andrius Vasiliauskas. Optical properties of DLC:SiOx and Ag multilayer films: surface plasmon resonance effect // Materials Science (Medžiagotyra), Vol. 22, No. 4. 2016, 481-485. (IF 0.51). http://www.matsc.ktu.lt/index.php/MatSc/article/view/13194
- Š. Meškinis, I. Yaremchuk, V. Grigaliūnas, A. Vasiliauskas, A. Čiegis. Plasmonic Properties of Nanostructured Diamond Like Carbon / Silver Nanocomposite Films with Nanohole Arrays // Materials Science (Medžiagotyra), Vol. 22, No. 4, 2016, 467-471. (IF 0.51). http://www.matsc.ktu.lt/index.php/MatSc/article/view/13193 (IF 1.759; Nr. 6 WoS - MATERIALS SCIENCE, COATINGS & FILMS, Q2 WoS - PHYSICS, APPLIED ir MATERIALS SCIENCE, MULTIDISCIPLINARY).
- T. Tamulevičius, D. Peckus, A. Tamulevičienė, A. Vasiliauskas, A. Čiegis, Š. Meškinis, S. Tamulevičius. Dynamic optical properties of amorphous diamond like carbon nanocomposite films doped with Cu and Ag nanoparticles // Proc. SPIE 9163, Plasmonics: Metallic Nanostructures and Their Optical Properties XII, 91632J (September 10, 2014); doi:10.1117/12.2061197 http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1905805
- Čiegis, A. Vasiliauskas, Š. Meškinis, S. Tamulevičius "UV irradiation effects on DLC:Ag films: charging of the plasmonic nanoparticles". ‑ in "Physics, chemistry and

applications of nanostructures" (eds.: V.E. Borisenko, S.V. Gaponenko, V.S. Gurin, C.H. Cam) Singapore: World Scientific, 2015, p. 319-325.

- Š. Meškinis, S. Tamulevičius. Diamond-like carbon based silver nanocomposites - short review of the technology and novel applications. - in "Physics, chemistry and applications of nanostructures" (eds.: V.E. Borisenko, S.V. Gaponenko, V.S. Gurin, C.H. Cam) Singapore: World Scientific, 2015, p. 319-325.

Self-supporting projects

- Innovation voucher, JSC Novatechas" contract No. 31V-229 (2013).

Experimental development service was provided, i.e. a prototype of refractive index sensor was created, its control software developed and experimental measurements with model materials were performed.

- Innovation voucher, JSC Lima, contract No. 31V-230 (2013).

Literature analysis and technical capability study were prepared. Diamond like carbon nanocomposite deposition technologies were overviewed and its application possibilities for silicon based solar cells were discussed.

- Innovation voucher, JSC Elkodi, contract No. 31V-231 (2013).

The analysis of literature has been done and a technical studio of possibilities was prepared. The advantages and disadvantages of diffractive optical elements which are available on the market and refractive index sensors were overviewed in the studio. KTU Institute of Materials Science developed research and achievements in the field of diffractive optical elements and refractive indices, and the technical possibilities to implement these products were described.

- Innovation voucher, JSC Sistemų Registras, contract No. 31V-219.(2013).

Current security level of form was investigated and recommendations for improvements were given. The company received consultations on implementation of optical security elements. Holographic security label, which can be easily recognised by general users and experts, was created.

- "**Development and Investigation of Means and Technologies for Optical Document Security**" (2013-2014), funded by JSC Ukmergės Spaustuvė

Optical document security means and technologies were developed for JSC Ukmergės Spaustuvė