Title (EN): **New thin film materials for gas sensors and hard metals and MEMS strguctures for chosen applications**

Title (SK)**: Tenkovrstvové materiály pre senzory plynov a ťažkých kovov a MEMS štruktúry pre vybrané aplikácie**

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Annotation: In the field of new thin film materials for gas sensors, we investigated the dependence of the titanium gas sensor sensitivity of TiO_2 on the total surface area of the active region. The surface area of TiO_2 was changed by plasma etching of structures with different configuration [2]. We also investigated the gas sensor on the basis of the semiconducting metal oxide Fe_2O_3, which was deposited by self-organization of nanoparticles with a diameter of 6-8 nm on gold interdigital electrodes. We have designed and optimized the technology for the preparation of embedded electrodes, which are necessary to create a continuous monolayer of Fe_2O_3 nanoparticles with a diameter of 6-8nm on solid electrodes with a thin film thickness of 100nm and electrode widths of several micrometers [3]. We proposed a new method of preparing the active thin layer of Cu_2O by potentiostatic electrodeposition on gold interdigital electrodes. In this case, the sensitivity of the gas sensor depends on the distance of the interdigital electrodes [8, 9]. We investigated the structure and optical properties of 2D layers of WS_2 (as perspective new 2D materials in optoelectronics and nanoelectronics) which were prepared by sulfurization of platinum layers of varying thickness. Platinum layers were prepared by magnetron sputtering [1]. The properties of the examined WS_2 layers are a prerequisite for their use as an active gas sensitive layer. We also investigated the characteristics of selected electron resists PMMA, AR-P 6200, HSQ and limiting factors in the electron lithography process for the TiO_2 thin film used in the gas sensor. The original results are the exposure parameters obtained for electron energy of 30 and 40 keV and the study of the resist structure profile dependence from the exposure parameters. We have gained new knowledge about electron interaction with electron resists on thin layers of semiconducting metal oxides TiO_2 [4 - 7]. We have also investigated the use of the MEMS pressure sensor on the EM field measurement principle [10]. In collaboration with Taiwan, in the framework of a joint bilateral project, we focused on the production of ultra-nano-crystalline (UNCD) and micro-crystalline (MCD) diamond emitters using MPECVD [11].

Main scientometric outputs:

1. HOTOVÝ, I. - SPIESS, L. - SOJKOVÁ, Michaela - KOSTIČ, I. - MIKOLÁŠEK, M. - PREDANOCY, M. - ROMANUS, H. - HULMAN, Martin - REHACEK, V. Structural and optical properties of WS_2 prepared using sulfurization of different thick sputtered tungsten films. In *Applied Surface Science*, 2018, vol. 461, p. 133-138. (4.439 - IF2017). ISSN 0169-4332. Typ: ADCA
2. NEMEC, P. - HOTOVÝ, I. - ANDOK, R. - KOSTIČ, I. Increased sensitivity of a gas sensor by controlled extension of TiO_2 active area. In *AIP Conference Proceedings: Applied Physics of Condensed Matter* (APCOM 2018), 2018, vol. 1996, no. 020032. ISBN 978-0-7354-1712-0. ISSN 0094-243X. Typ: ADMB
3. HRKÚT, Pavol - KOSTIČ, Ivan - BENKOVIČOVÁ, Monika - KOTLÁR, Mário - LUBY, Štefan. Silicon substrates for nanoparticle gas sensors with embedded electrodes and planar surface. In *AIP Conference Proceedings : Applied Physics of Condensed Matter* (APCOM 2018), 2018, vol. 1996, no. 020018. ISBN 978-0-7354-1712-0. ISSN 0094-243X. Typ: ADMB
4. KOLEVA, Elena - VUTOVA, Katia - KOSTIČ, Ivan. Simulation and experimental study on developed profiles in the positive polymer resist PMMA. In *Journal of Physics: Conference Series*, 2018, vol. 1089, art. no. 012015. ISSN 1742-6588. Typ: ADMB

5. KOLEVA, Elena - VUTOVA, Katia - ASPARUHOVA, Boriana - KOSTIČ, Ivan - CVETKOV, K. - GERASIMOV, V. Modeling approaches for electron beam lithography. In *Journal of Physics: Conference Series*, 2018, vol. 1089, art. no. 012016. ISSN 1742-6588. Typ: ADMB
6. KOSTIČ, I. - VUTOVA, K. - ANDOK, R. - BARÁK, V. - BENČUROVÁ, A. - RITOMSKÝ, A. - TANAKA, Takeshi. Experimental and theoretical study on chemically semi-amplified resist AR-P 6200. In *Journal of Physics: Conference Series*, 2018, vol. 992, art. no. 012057. ISSN 1742-6588. Typ: ADMB
7. CVETKOV, Kristian - GERASIMOV, Vladislav - KOSTIČ, Ivan - KOLEVA, Elena - VUTOVA, Katia - ASPARUHOVA, Boriana. Electron beam energy deposition and resist profile modeling during electron beam lithography process. In *International scientific conference High technologies*. business. society : Proceedings, Volume I "High technologies". - Sofia, Bulgaria : Scientific Technical Union of Mechanical Engineering Industry-4.0, 2018, vol. II, no. 1, p. 124-127. ISSN 2535-0005. Typ: AFC
8. MIKOLÁŠEK, M. - MERI, Július - CHYMO, F. - ONDREJKA, Peter - REHACEK, V. - PREDANOCY, M. - KOSTIČ, Ivan - HOTOVÝ, I. Novel Cu_2O gas sensor prepared by potentiostatic electrodeposition on IDE electrodes and Microsystems. *European Workshop*. - Bratislava : Slovak University of Technology, Bratislava, 2018, p. 87-92. (MME 2018 : 29th Micromechanics and Microsystems Europe Workshop). Typ: AFD
9. Miroslav Mikolášek, Peter Ondrejka, Filip Chymo, Vlastimil Řeháček, Martin Predanocy, Ivan Kostič, Ivan Hotový. Cu_2O Based Gas Sensor Prepared by Electrodeposition. In *ASDAM 2018 : the 12th International Conference on Advanced Semiconductor Devices and Microsystems*. - IEEE, 2018, p. *. ISBN 978-1-5090-3081-1. Typ: AFD
10. ANDOK, Róbert - HARŤANSKÝ, René - HRICKO, Jaroslav - HALGOŠ, Ján. Concept of a MEMS load cell sensor of mechanical quantities based on the EM field principle. In *AIP Conference Proceedings : Applied Physics of Condensed Matter* (APCOM 2018), 2018, vol. 1996, no. 020002. ISBN 978-0-7354-1712-0. ISSN 0094-243X. Typ: ADMB
11. CHENG, Wen-Hsiu - TSAI, Ping-Huan - CHEN, Yi-Huang - TSAI, Hung-Yin - ANDOK, Róbert. Fabrication of field emitters of ultra-nano-crystalline and micro-crystalline diamond films by the MPECVD method. In *AIP Conference Proceedings : Applied Physics of Condensed Matter* (APCOM 2018), 2018, vol. 1996, no. 020020. ISBN 978-0-7354-1712-0. ISSN 0094-243X. Typ: ADMB
12. Invited lecture: RNDr. Ivan Kostič: Limitations of electron beam lithography in the research and industry. *EBT 2018 - 13th International Conference on Electron Beam Technologies*, Varna, Bulharsko