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Comparable Analyze of TiO₂ Properties on Ti Formed by Laser Radiation, Sol-Gel, Electrochemical Anodization and Magnetron Sputtering

A. Medvids^{1*}, P. Onufrijevs¹, E. Letko¹, S. Gaidukovs², A. Knoks¹, R. Eglitis³, I. Skadins⁴, S. Varnagiris⁵, M. Milčius⁵, A. Zunda⁶, J. Padgurskas⁶, H. Mimura⁷

¹*Institute of Technical Physics, Faculty of Materials Science and Applied Chemistry, Riga Technical University, P. Valdena 3/7, Riga LV-1048, Latvia*

²*Institute of Polymer Materials, Faculty of Materials Science and Applied Chemistry, Riga Technical University, P. Valdena 3/7, Riga LV-1048, Latvia*

³*Institute of Silicate Materials, Faculty of Materials Science and Applied Chemistry, Riga Technical University, P. Valdena 3/7, Riga LV-1048, Latvia*

⁴*Department of Biology and Microbiology, Riga Stradins University, 16 Dzirciema Street, Rīga, LV 1007, Latvia*

⁵*Center for Hydrogen Energy Technologies, Lithuanian Energy Institute, 3 Breslaujos St., Kaunas, Lithuania*

⁶*Aleksandras Stulginskis University, Institute of Power and Transport Machinery Engineering, Lithuania*

⁷*Research Institute of Electronics, Shizuoka University, 3-5-1, Johoku, Naka-ku, Hamamatsu 432- 8011 Japan*
**medvids@latnet.lv*

It is well known that TiO₂ is one of prominent materials, which can be applied as a catalyst in hydrogen fuel production, biodegradation, environmental cleaning, etc. Every application requires precise controllability of synthesis and polymorph phase. TiO₂ can be obtained by various methods, however, each of them has some limitations in specific applications. The aim of the study is the comparison of chemical, mechanical and catalytic properties of TiO₂ layers formed by different methods for applications in medicine, chemistry and physics. The result of the investigation is the knowledge about best parameters of these TiO₂ coatings on Ti, including recommendations for applications in each of the fields. In the investigation of TiO₂ layers on Ti substrate formed by laser irradiation, sol-gel, electrochemical anodization and magnetron sputtering methods were studied. The topics covered by the study are following: 1. The developed new technologies and TiO₂ coatings, obtained by these technologies within the study, are products with increased added value; 2. The TiO₂ layer with optimized and stable catalytic properties is very important for energy sector, since it has an important application in hydrogen energetics; 3. TiO₂ is well known catalyst, used in waste water purification, therefore, optimization of its catalytic properties is very important for nature and environment protection; 4. TiO₂ coatings on Ti are used in medicine because of their antibacterial properties. Testing and optimization of these properties are thus related to the public health. As a result of comparable analyze of TiO₂ layer formed on Ti substrate, properties were found: the mechanical properties (adhesion and brittleness) of the structure are the best for laser processing; antibacterial properties is better for sol-gel methods, which was determined by colonization of *Ps. Aeruginosa* and *S. Epidermidis* bacteria; photocatalytic study revealed that the TiO₂ layers formed by magnetron sputtering method has shown that decomposition velocity is the best using methylene blue solution.

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