

Nanostructured surfaces

Nanostructured tungsten oxide films for gas sensing application

V.S. Solntsev, T.I. Gorbanyuk, V.G. Litovchenko

Institute of Semiconductor Physics, National Academy of Science of Ukraine, 41 prospect Nauki, 03680, Kiev, Ukraine, e-mail: solarstar@ukr.net

Semiconductor metal oxides are not a new material, but it is only relatively that its true nanostructure and surprising properties have come under scrutiny [1]. Furthermore, metal oxides are widely known as the materials for catalysis, sensors, solar cells and one that have significant technological implications. As a consequence, the devices based on metal oxides devices are widely used in environmental monitoring and in industry that influences our everyday lives.

One of the class oxides such as nanostructured tungsten oxide films have unique physical and chemical properties that make it suitable for various applications such as electrochromic devices, catalysts and/or gas sensors [2, 3].

The present work describes the results of investigations of sensor structures based on nanostructured tungsten oxide under gas adsorption. The developed technology includes the two steps. At first, tungsten film was fabrication by magnetron sputtering. At second, nanostructured tungsten oxide film was formed due to thermal oxidation in an oxygen atmosphere. The morphology and structure of samples were characterized by atomic force microscopy (AFM), X-rays analysis and Raman spectroscopy. Nanostructured films consisted of crystalline aggregates that possess a mean size of about 50-300 nm. X-rays analysis and Raman spectroscopy confirmed that oxide films having monoclinic phase. Also the samples were investigated as gas sensitive structures under hydrogen (H₂) and hydrogen sulphide (H₂S) gases influence. The sensor structures have high sensitivity both H₂ and H₂S. Mechanism of an adsorption of nanostructured tungsten oxide film has been proposed.

1. *Jose A. Rodriguez, Marcos Fernandez-Garcia. Synthesis, properties, and applications of oxide nanomaterials. // JohnWiley & Sons, Inc., Hoboken, New Jersey – 2007.*
2. *Jun, J.-M., Park, Y.-H., Lee, C.-S. Characteristics of a metal-loaded SnO₂/WO₃ thick film gas sensor for detecting acetaldehyde gas. // Bulletin of the Korean Chemical Society – 2011.- vol. 32 (6).- pp. 1865-1872.*
3. *Kukkola, J., Mõklin, J., Halonen, N., Kyllönen, T., Tyth, G., Szaby, M., Shchukarev, A., (...), Kordós, K. Gas sensors based on anodic tungsten oxide. // Sensors and Actuators, B: Chemical. – 2011. – vol.153 (2). - pp. 293-300.*