

Nanostructure architecture and nanostructure organization of a sensor matrix for differential analysis of complex gas media

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It is at the interface between different disciplines and research areas that technical solutions important to both the fundamental science and various applications arise most frequently. The work under consideration is a result of joint efforts of physicists, chemists, and IT developers aimed at the creation of a new generation of sensor devices.

The proposed technical solution is based on the unique properties and opportunities offered by nanostructures. The approach used allowed the authors to expand the existing set of options and significantly improve the metrological characteristics of conventional sensor devices for analysis of gas media. The sensing element was made in the form of a sensor matrix consisting of Yanson point contacts [1]. The unique properties of this nanostructure make it possible to obtain an easily registered response to the action of minute quantities of the analyte, down to a single molecule [2]. The use of a specially synthesized material enhances drastically the sensor properties of the sensing element. The material of the point contact conduction channel is a ternary alloy W-Mo-Co, whose components are widely used in gas media sensors. The technique of the alloy electrochemical production and the electrolysis regimes provide unique functionality of the material due to the formation of a specific nanostructure [3]. The sensor material contains nanostructured cluster inclusions connected with each other by nanochannels with direct conductivity. The nanochannels meet the criteria of the Yanson point-contact spectroscopy and can be considered as conductivity channels of Yanson point contacts [1]. Therefore, the synthesized alloy can be viewed as a kind of metamaterial with the functional properties provided by a unique nanostructure organization that allow one to realize the effect of enhanced sensitivity of point contacts discovered by the authors [2].

When in contact with a complex gas media, the nanostructured sensing element generates a complex response curve in the form of a spectrum-like chrono-resistogram [2]. Analysis of the curve with the help of a special IT program allows one to reliably identify qualitatively and quantitatively the components of the gas analyte.

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