

New features of the Rutherford Backscattering Spectroscopy in powder nanotechnologies

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Rutherford Backscattering Spectrometry (RBS) is an ion scattering technique used for compositional thin film that are less than 1 μ m thick analysis. During an RBS analysis, high-energy He²⁺ ions with energies in the region from several hundred kiloelectron-volts to 2 - 3 MeV are directed onto the sample and the energy distribution and yield of the backscattered He²⁺ ions at a given angle is measured. Since the backscattering cross-section for each element is known it is possible to obtain a quantitative compositional depth profile from the RBS spectrum obtained.

The capabilities of this method can be significantly expanded. In particular, the method can be used in powder nanotechnology to study elemental composition in microscopically small objects.

The application of methods based on Rutherford Backscattering Spectrometry is extremely interesting for adsorption energy devices, in particular, these methods can be used with maximum efficiency for various chemoelectronic converters.

A unique opportunity is to study the elemental surface of adsorbates on the surface phase separation in functional nanostructured layers.

For this reason, the preparation of planar-distributed chemoelectronic converters and the study of the elemental composition of adsorbates using the Rutherford Backscattering Spectrometry technique was the purpose for the investigation.

The tasks of this study included: development and optimization of the technology for producing planar chemoelectronic converters a functional layer in the form of rounded drops containing monodisperse nanosized (7.5 μ m) particles of a solid solution of the ZrO₂ system - 3 mol% Y₂O₃ (YSZ) in the PVA polymer matrix, study of the theoretical characteristics of the obtained chemoelectronic converters [1], study of the elemental composition of the obtained chemoelectronic converters using Rutherford Backscattering Spectrometry.

The atomic and chemical composition of these layers has been studied using nuclear and atomic methods.

The thickness of the oxide layers was found to be approximately the same for all implanted samples. These values were determined on the basis of Rutherford Backscattering Spectrometry and nuclear reactions (RBS/NR).

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[1] L. Chemical-Electric Energy Conversion Effect in Zirconia Nanopowder Systems A. S. Doroshkevich, A. I. Lyubchyk, A. V. Shilo, T. Yu. Zelenyak, V. A. Glazunovae, V. V. Burhovetskiy, A. V. Saprykina, Kh. T. Holmurodov, I. K. Nosolev, V. S. Doroshkevich, G. K. Volkova, T. E. Konstantinova, V. I. Bodnarchuk, P. P. Gladyshev, V. A. Turchenko, S. A. Sinyakina. (2017). Journal of Surface Investigation: X-ray, Synchrotron and Neutron Techniques Vol. 11, No. 3. - Pp. 523–529. DOI: 10.1134/S1027451017030053.

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