Metrological support of nanotechnologies

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Abstract

Metrology plays the key role in the development and commercialization of nanotechnologies and nanoproducst as the level of measurement trustworthiness and accuracy provides either the development of corresponding brunches of industry or serves as a restraining factor. The specifics and stormy development of nanotechnologies have led to the appearance of a new direction in metrology called nanometrology, which embraces all theoretical and practical aspects of metrological support to provide the uniformity of measurements in nanotechnologies.

Now some scientific and technical background in field of measuring geometrical parameters in nanorange is accumulated in Russia. Length standards for small lengths (standards for comparison) by means of which it is possible to calibrate scanning probe microscopes (SPM) and raster electronic microscopes (REM) which are the main instruments in research and evaluation of geometrical characteristics of nanosize objects have been developed [1]. Since January 2008, four State Standards in field of creating length standards for small lengths and calibrating tools for measuring geometrical characteristics in nanorange have come into force in Russia. However, the existing basis of standards and methods in other kinds of measurements meet neither the measuring requirements of nanotechnologies and nanomaterials fabrication nor the requirements of their safe exploitation. The analysis of the current situation with metrological support of nanotechnologies has revealed the following vital requirements in this field:

- to develop well-grounded requirements to the basis of standards, the system of standard measures and standard samples and to develop new means and methods of measurements, tests, verification and calibration in field of nanotechnologies;
- to modernize the existing standards by means of significant increasing the accuracy of reproduction and transfer of the units of values and to create new standards and precision information measuring complexes which are necessary for uniformity in field of nanotechnologies;
- to develop the complex of technical regulatory documents in order to provide the uniformity of requirements and their conformity with international requirements;
- to arrange participation of Russian standards for nanotechnologies and nanoindustry in international checkings and to provide the international recognition of measuring and calibrating abilities.
- to develop the methods of obtaining and certification of standard samples of substances and nanomaterials, standard measures and test-objects for calibration of the means of measurements;
- to supply measuring and analytic nanolaboratories with modern high-precision measuring equipment including the equipment based on spectroscopy with electronic and ion sources, radio and X-ray spectroscopy, hybrid methods of atomic emission, liquid and gas chromatography in combination with the methods of mass-spectrometry, IR and UV-spectrometry.

Keywords: Nanometrology, the basis of standards, uniformity in field of nanotechnologies.

References