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Editorial

Recent Progress in Surface and Interface Properties of Nanostructures

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The surface of any solid-state object is characterized by enhanced surface energy as compared with the volume of a part of the bulk object. This is connected with the presence of a great number of dangling bonds, certain defects—vacancies and dislocations—and atoms as well as molecules adsorbed on the surface of a solid. The presence of such a set of defects means a high chemical activity of the surface relative to that in the bulk of a solid, thus resulting in such unwanted impacts as the corrosion of materials, the adsorption of undesirable gases and liquids from the medium, and the segregation of impurities from the bulk of the material to its surface. These effects can provide advantageous as well as disadvantageous features to materials. Such properties are quite clearly expressed in nanostructures. At present, various nanostructures are widely utilized in electronics, medicine, and sensor technologies.

Coatings, including organic ones, are actively used for the protection of nanomaterials' surfaces which are applied in the production of luminescent elements, heterostructures, and solar cells. Selectively transmissive coatings are often used in the fabrication of various sensors. Special attention is paid to porous nanomaterials, with great value attributed to their pores' surfaces. They are employed in optoelectronics, sensor devices, and when they are used as catalysts. Multifunctional thin-film nanostructures can also be used as anti-reflection coatings, for the masking of objects in the environment, and so on. A rather large number of works is concerned with the subjects of interface properties in multifunctional composites, as well as with the characteristics of the metal–dielectric matrix and hybrid composites.

For all of these objects it is very important to provide proper surfaces, allowing for devices with high-quality and adjusted characteristics. A separate direction of investigations into the range of surface and interface properties of nanostructures is connected with the study of degradation processes and methods of their inhibition and prevention.

Some specific properties of the surfaces of these materials establish conditions for the development and active use of precise diagnostic methods for nanomaterials, including, first of all, a technique for analyzing surfaces and interfaces, such as X-ray photoelectron spectroscopy, Raman spectroscopy, probe methods for the study of surface morphology, as well as combination of the latter ones with high-resolution microscopy [1–3].

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