Editorial

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The present issue contains papers from the 8th Seminar on Surface Phenomena and Nanosized Systems at the A.N. Frumkin Institute of Physical Chemistry and Electrochemistry of the Russian Academy of Sciences, Moscow, Russia, held on 1–2 February 2017. Thirty papers were presented orally at the seminar, eight of which are published here. The seminar addressed recent developments in the broad, interdisciplinary research field of nanosized systems and nanostructured materials with an emphasis on the role of surface phenomena. The presented contributions were focused on fundamental colloid–chemical aspects of nanotechnology, experimental methods of surface investigation and nanodiagnostics, numerical methods for studying surface phenomena and nanosystems, wetting, capillary phenomena and nanofluidics. These general topics are the subject of much current research in fields as diverse as physics, chemistry and nanoscience. The main reason for the abiding interest in surface phenomena is that they are fundamental in nature, play a critical role in industrial applications of nanostructural materials and in the development of new nanotechnologies, and are fun to study. With the advent of improved computational methods, advances made in experimental techniques and development of sophisticated instrumentations, it is shown in the papers collected in this issue that even the most basic concepts, which are applied on a daily basis, are still hotly debated. While the individual articles may seem disparate in content, thoughtful readers can discern a leading role of surface phenomena in a number of intriguing observations and problems presented in this collection.

The first paper in the collection, written by Gor'kov *et al.*,¹ discusses the method of a redox colloidal synthesis of 'inorganic particles–conjugated polymer' composite as overcoats on the surface of an inert support. The developed method was demonstrated for the design of palladium–polypyrrole composites on the surface of carbon nanotubes. The fabricated three-phase composite nanosystems are attractive for numerous applications in organic syntheses as efficient immobilized catalysts, characterized by facilitated separation from solute reaction products.

The effect of halloysite nanotubes and platinum nanoparticles used for modification of the bi-layer perfluorinated membrane MF-4SC, an analog of Nafion-117, on the transport characteristics of composite membranes was studied by Filippov *et al.*² The data on transport and selectivity properties along with power characteristics in the membrane-electrode block of the fuel, measured by authors, lead them to predict the effective use of the designed hybrid membranes both as the separating diaphragms in fuel cells and electromembrane devices and as promising catalytic systems.

In the paper by Wiśniewska *et al.*,³ the detailed analysis of factors affecting the stability of aqueous dispersions of colloidal silica was given on the basis of turbidimetric studies. The stability/instability of aqueous dispersions is a key factor in many technological applications of nanodispersions, such as in the food, pharmaceutical and chemical industries. The experimental data reported allows estimation of the impact of chemical structure and the charge of natural and synthetic polymer additives on the electrostatic and steric mechanisms of dispersion stabilization.

The routes for fabrication and application of superhydrophobic coatings are demonstrated by Bryuzgin *et al.*⁴ and Ganne *et al.*⁵ Nowadays, the fascinating and burgeoning area of superhydrophobic coatings attracts the attention of academia and industry and is widely discussed by the scientific community. Both papers give bright examples of an extremely wide area of fundamental and applied research in the branches of nanotechnology targeted on the fabrication of protective superhydrophobic coatings. The lauryl methacrylate and glycidyl methacrylate copolymers grafted by Bryuzgin *et al.*⁴ onto cotton fabric allow achievement of the superhydrophobic state of fabric surface with a long-term chemical stability in acidic and alkaline media. In the paper by Ganne *et al.*,⁵ the significant anti-icing potential was demonstrated for the protective coating, fabricated using laser texturing and fluorooxysilane chemisorption on the surface of stainless steel meshes. The detailed experimental testing of the developed coating at different conditions allowed authors to estimate the range of outdoor conditions when the coatings show reliable anti-icing properties.

Equilibrium and dynamics of wetting of uniform and heterogeneous surfaces were regularly discussed in the literature for some 200 years. Recent fundamental advances in the subject area are mostly related to a better understanding of peculiarities of three phase contact zone and interactions at the nanoscale. In the paper by Samsonov *et al.*,⁶ the solid-state wetting phenomenon and spreading of solid metallic nanoparticles along the grains of the same metal are considered, on the one hand, using molecular dynamics and, on the other, on the basis of the capillary induced surface diffusion concept combined with similarity considerations. Solid-state wetting phenomenon plays an important role in sintering micro and nanoparticles onto solid surfaces, in chemical vapor deposition, in thin films equilibration upon annealing process, and in a number of related technologies. The results obtained by Samsonov *et al.*⁶ confirm the importance of capillary driven motion for the solid-state wetting phenomenon and the

coexistence of metallic nanoparticles with macroscopic metal bodies.

Gątarski and Nowicki⁷ studied the effect of wettability on the motion of a droplet atop a heterogeneous surface subjected to mechanical vibrations. Analysis of droplet trajectory and shape upon movement across a series of parallel stripes of monotonically increasing width and two alternating contact angles was done using computer simulations based on a finite- element method. The authors then postulate the ratchet mechanism of unidirectional droplet motion.

In the paper by Pytskii *et al.*,⁸ a new approach for stabilization of metal clusters and metal charged ions on surfaces was demonstrated using mass spectrometry with surface-assisted laser desorption/ionization. This cluster stabilization technique was successfully applied for investigation of surface morphology and determination of trace amounts of amino acids on carbon black, aluminum alloys and stainless steel surfaces.

The collection of papers presented in this issue stresses the key role that surface phenomena play in materials science and engineering today. I am grateful to our authors and reviewers for their conscientious and expeditious writing and reading. Above all, I would like to thank Professor Jarosław Drelich for proposing this issue and his support throughout the editorial process.

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