

Fourth Russian Conference on “Chemistry of Surface and Nanotechnology”

A. A. Malygin, Chairman of the Organizing Committee

Received January 13, 2010

DOI: 10.1134/S1070363210060010

This issue of the Journal contains some materials from the Fourth Russian Conference (with international participation) on “Chemistry of Surface and Nanotechnology.” The conference took place from September 28 to October 2 in resort “Khilovo” (Pskov oblast). It was organized by the Saint-Petersburg State Technological Institute, Scientific Councils of the Russian Academy of Sciences on colloid chemistry, physicochemical mechanics, and inorganic chemistry, Saint-Petersburg Division of the Russian Chemical Society under the support of the Federal Agency on science and innovations, Russian Foundation for Basic Research, and Companies of the group “NT-MDT.”

Already 10 years have elapsed since the first analogous conference, and this period may be characterized as the transition from fundamental research to the extensive implementation of the results of these investigations into the industry. Just in this interval (2007) a state corporation Rosnano was founded in Russia for support of the implementation of the nanotechnology and nanomaterials into the industry. Two nanoforums (2008 and 2009) were organized under the aegis of the Rosnano, a great attention was paid to the nanoscience at the most important international conferences “Colloid-2008” and Mendellev Congress (2007). Both the latter and the conference in Khilovo were dedicated to the 175-th anniversary since the birth of D.I. Mendeleev, and a special lecture of A.I. Rusanov marked this occasion.

The book of abstracts of the conference includes over 270 items of the reports of 750 authors from Russia, Ukraine, Belarus, France, Germany, Finland, Kazakhstan, Canada, Rumania, Poland, Moldova, USA, and Azerbaijan. The immediate participants were representatives of 20 High Schools, 15 Institutes of the Russian Academy of Sciences and 11 industrial organizations from Russia, Universities of Belarus (Minsk), Ukraine (Kiev), France (Bordeaux),

and also companies from Germany and Finland. The program of the conference contained 11 plenary lectures, 35 oral reports, and four poster sections: Synthesis and quantum-chemical simulation of small-dimension systems (92 posters), equipment for the synthesis and research methods for the small-dimension systems (26 posters), functional properties and application fields of nanomaterials (98 posters), and education in the field of surface chemistry and nanotechnology (8 posters). These publications contain a wide range of information on nanotechnology procedures and investigation methods, functional properties of nanostructures, and also the problems of personnel training for nanotechnology and application of nanomaterials. On the other hand the advances were demonstrated in the chemistry of solid surfaces and application fields of nanomaterials concerning all the problems of the solid-phase material science: elemental base of the nanoelectronics, sorption catalytic systems, materials for medicine, construction and composite materials, including polymers.

The participants of the conference reported on the results of the studies of chemical reactions on the surface of the solid-phase matrices with inorganic and organic reagents. Both in the plenary lectures (A.A. Malygin, G.V. Lisichkin, I.P. Suzdalev, S.E. Aleksandrov), in oral reports and communications in the sections the regularities were described of the physicochemical interactions between the functional groups on the solid surfaces and the reagents, the connection was established, on the one hand, between the chemical character of the groups on the surface, their topography and concentration, and on the other hand, the composition and structure of the arising from the reaction surface nanostructures. In the studies of the chemical reactions on the surface quantum-chemical simulation of the processes and of functional characteristics of the forming products found further

development. An important fundamental approach consists in the development of thermodynamic and kinetic aspects of the discussed transformations of nanostructures (A.I. Rusanov, I.P. Suzdalev, and others).

A sufficient attention was paid to the up-to-date apparatuses for synthesis. The investigation and identification of small-dimension objects was carried out applying practically all modern physical and chemical analytical methods: electron spectroscopy of diffuse reflection, FTIR spectroscopy, X-ray photoelectron spectroscopy, secondary ion mass spectrometry, scanning electron microscopy, X-ray fluorescence analysis, nuclear gamma-resonance, electron spin resonance, ellipsometry, Mössbauer spectroscopy, optical spectroscopy of anisotropic reflection, Raman spectroscopy, field emission spectroscopy, thermal-desorption mass spectrometry, diffraction of reflected fast and slow electrons, positron beam annihilation spectroscopy, atomic force microscopy (AFM), scanning tunnel microscopy (STM), indicator method of estimating the acid–base characteristics of surface.

In the plenary lecture of V.A. Bykov heading the group of the companies “NT-MDT” producing instruments and equipment based on STM and AFM the conditions and prospects of development of the nanotechnology instruments were outlined. It was stated that recently the attention was focused on the creation of the nanotechnological complexes which might be produced in cluster and multimodal versions, and also complexes attached to unique installations (synchrotrons, pulse lasers on free electrons) that alongside the high spatial resolution (about 10 nm) made it possible to attain high time resolution (up to 0.1 ns).

It should be noted that the application range of materials obtained with the use of nanotechnology considerably extended. In this respect should be mentioned the synthesis of biocompatible surfaces (A.P. Alekhin) and nanodiamonds (I.I. Kulakova) for biology and medicine; production of new sorption and catalytic materials, in particular, for the membrane processes, sensor probes (G.F. Tereshchenko, A.A. Evstratov, M.I. Ivanovskaya, M.M. Ermilova); preparation of polymeric, among them composite, nanomaterials with improved functional properties

(L.I. Kravets, A.Yu. Men’shikova, S.A. Trifonov), metal and alloy nanopowders (I.P. Suzdalev, V.E. Prusakov, V.P. Korzhov), and also nanopowders for magnetic recording, Langmuir–Blodgett films with improved tribotechnical characteristics. A number of reports described the real implementation of nanotechnologies and nanomaterials, and designing the processing equipment for their production. The employment of nanomaterials (ultradisperse clay powders, nanotubes) was reported for manufacturing industrial polymer films with increased barrier and electrophysical properties (G.V. Zhukov, K. Kollert); the industrial nanotechnologic installations were described used for atomic-beam epitaxy (analog of the molecular-beam epitaxy) and the field of their practical applications (V.A. Tuzovskii and Finnish “Benek” Co.); the creation of automated installations for the molecular assembling from the liquid phase (D.A. Kravchenko); the application of plasmochemical processes, in particular, with the use of remote plasma, in the preparation of ultrathin films, semiconductor heterostructures, nanocrystals, nanofibers, and nanotubes (S.E. Aleksandrov); the application of the molecular beam epitaxy for production of nanomaterials of versatile functional destination (A.A. Malygin).

A round-table discussion dedicated to the problem “Is the wide implementation of nanotechnology and nanomaterials a myth or reality?” attracted about 50 participants. The discussion concerned the role of the state structures, industrial enterprises, and business companies in the development of the nanotechnology, the formulation of problems and the direction of the research, in the financing of the promising projects, in the practical implementation of the completed research and design work.

For the first time in the framework of the conference of this series a competition was carried out among the research works of young participants. The Organizing Committee chose three winners who obtained diplomas, money prizes, and presents. Besides with diploma and money prizes the best reports in the nominations among students, postgraduate students, young researchers, and lecturers were rewarded. For the active participation in the work of the conference 13 young scientists were awarded by the Organizing Committee with special documents.