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Department of Chemistry of the Kyiv National Taras Shevchenko University



This issue of the Journal is devoted to the 170th anniversary of the Kyiv National Taras Shevchenko University (KNU) and comprises reviews written by professors and researchers of the Department of Chemistry of KNU and reflecting traditional and novel trends of research carried out at the Department.

The Kyiv University was founded in 1834. Chemistry was taught at the University from the moment of its foundation; research activities were also begun at that time. In 1904, a special building was built for the University chemists and the next year a department of chemistry was established within the University structure. Many prominent chemists, such as S M Reformatsky, A K Babko, A M Golub, A T Pilipenko, O V Palladin, I V Pyatnitsky, A I Kiprianov, K B Yatsimirsky, F S Babichev, Yu K Delimarsky and V N Yeremenko have worked there at different times. To date, the research staff of the Department of Chemistry comprises 208 people including 68 professors and 140 researchers.

The Department takes an active part in comprehensive research programmes of the KNU and the European Union. It maintains and develops constant collaboration with leading research centres in Russia, Poland, USA, Germany, Great Britain, France and Italy. An agreement for joint activities in 2001 – 2005 concluded between the departments of chemistry of the Kyiv National Taras Shevchenko University and M V Lomonosov Moscow State University is aimed at the design of new generations of functional materials, polymers, flocculants and drugs. The Division of Inorganic Chemistry collaborates with Wroclaw (Poland) and Leipzig (Germany) Universities. The studies at the Division of High-Molecular Compounds are carried out within the framework of collaboration programmes between KNU, Gdansk University and Radom Technical University (Poland), the Research Centre LG Gable (Korea) and the Charles Sadron Institute (France). The Division of Organic Chemistry collaborates with Toulouse University (France). The researchers of the Division of Physical Chemistry are carrying out joint research with their colleagues from York University (Great Britain).

The Department of Chemistry takes an active part in the organisation and holding of various national and international conferences; in particular, it was the organiser of the 21st International Chugaev Conference in June 2003 dedicated to the 130th anniversary of L A Chugaev.

The Department of Chemistry of KNU consists of five divisions, *viz*., the Divisions of Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry and Chemistry of High-Molecular Compounds. Future chemists are trained there in nine specialities.

Studies devoted to the synthesis and structural analysis of coordination compounds and studies of complexation reactions of transition metals in various media occupy a significant place in the research activities of the Division of Inorganic Chemistry. Its major achievements include the development of a direct (one-step) synthesis of coordination compounds from metal powders and metal oxides, which has enabled easy preparation of a series of novel compounds which cannot be synthesised by traditional methods. The results of these studies have been generalised in the monograph by V V Skopenko, A D Garnovskii, V M Kokozey *et al*., 'Direct Synthesis of Coordination Compounds' (1997).

Considerable attention in the past decade has been given to metal complexes with amide, hydrazide, oxime and carbacylphosphoramidate ligands possessing interesting catalytic and

physical properties. These investigations are considered in the review by V V Skopenko, V M Amirkhanov, T Yu Sliva, I S Vasilchenko, E L Anpilova and A D Garnovskii 'Various types of metal complexes based on chelating β-diketones and their structural analogues'.

Yet another trend of research at the Division of Inorganic Chemistry is related to the design of novel inorganic materials possessing non-linear optical and specific electrophysical properties. In particular, studies of the regularities of phase formation of phosphates in solution-melt media of multicomponent systems and under solid-phase interaction conditions; synthesis of heterosubstituted crystalline templates of double phosphates and study of relationships between compositions, structures and properties of novel compounds are under way. Studies into the synthesis of complex phosphates under conditions of hydrothermal interaction are carried out jointly with the Institute of Magnetism of the National Academy of Sciences of the Ukraine. This trend of research is represented in the review by V V Skopenko, V V Lisnyak, N V Stus and N S Slobodyanik 'Phosphate tungsten bronzes'.

The traditional trends of research at the Division of Analytical Chemistry include studies of extraction and sorption processes which serve as the basis for the development of the most advanced methods of environmental analysis and control. The approach including the design, analysis and applications of solid-phase analytical reagents is also being developed successfully. Unique adsorbents for selective solid-phase concentration and separation of metal ions, pesticides, antibiotics and phenols in environmental objects and biological fluids and selective membranes for chemical and biological sensors have been designed. These problems are surveyed in the monographs by Yu V Kholin and V M Zaitsev 'Complexes on the surface of chemically modified silica' (1997) and by V M Zaitsev 'Complex-forming silica: synthesis and structures of graft layers and surface chemistry'. Other studies are concerned with the practical application of a novel concentration procedure, *viz*., micellar extraction or microcomponents from aqueous solutions using non-ionic surfactants. These studies gave an impetus to the development of methods for determining surfactants and toxic organic compounds in natural and waste waters.

The main lines of research at the Division of Organic Chemistry include asymmetric synthesis of organic compounds, stereochemistry, studies into mechanisms of chemical reactions, synthesis and investigation of heterocyclic and biologically active compounds, chemistry of proteins and carbohydrates and computer chemistry. The review by A A Pokholenko, Z V Voitenko and V A Kovtunenko 'Pyrido- and pyrimidoisoindoles: methods of synthesis and properties' summarises the data on the synthesis, physical and chemical properties of pyrido- and pyrimidoisoindoles with unusual electronic structures.

One of the most modern trends of research, *viz*., calculation of atomic clusters using most advanced computer programmes, is being intensively developed at KNU. In recent years, research activities of KNU investigators have been focused on the design of fluorescent probes and ionic indicators as well as peptidomimetics and peptide models. A systematic search for biologically active compounds is under way. This line of research is discussed in the review by I V Komarov, A O Grigorenko, A V Turov and V P Khilya 'Conformationally rigid cyclic α-amino acids in the design of peptidomimetics, peptide models and biologically active compounds'.

Studies into physicochemical, adsorption and catalytic properties of metal-containing systems as well as thermodynamic and structural studies of metal and oxide melts are traditional subjects of investigation at the Division of Physical Chemistry. These include studies of interactions of gas molecules with surfaces of solids including melts. An important role of heterogeneity and polymorphism in adsorption-catalytic properties of melts has been demonstrated and the microheterogeneity phenomenon in melts has been established. The oxidation mechanisms of small molecules (CO, H_2, CH_4) on surfaces of metal catalysts have been investigated and some novel classes of metal-containing catalytic systems have been discovered. The theoretical grounds for the mechanisms underlying the effects of non-ionogenic water-soluble polymers on electronic-surface properties and aggregate resistance of coarse-dispersion systems have been developed. Structure–activity relationships of ice-forming compositions of various chemical nature have been established based on an analysis of a mosaic model of a hydrophilic-hydrophobic surface. Of special noting is the synthesis of adsorption-semiconducting gas sensors, development of various devices based on them and determination of thermodynamic characteristics of various novel binary and ternary metal systems containing aluminium, germanium, silicon, *etc*.

The main trend of research at the Division of High-Molecular Compounds is the synthesis and modification of polymers, monomers and other compounds and their use in the design of polymeric compositions possessing unique properties. Novel polymeric materials for microelectronic engineering have been developed. Numerous polymeric photosemiconductors, polymeric solid electrolytes, photosensitive polymers and compositions and biologically active polymers have been prepared.

The interest in heteropolymeric systems, such as intermolecular polycomplexes (InterPC) as well as block and graft polymers has increased considerably in the past decade due to the explosive development of nanophase materials science. The review by T B Zheltonozhskaya, N E Zagdanskaya, O V Demchenko, L N Momot, N M Permyakova, V G Syromyatnikov and L R Kunitskaya 'Graft copolymers with chemically complementary components as a special class of high-molecular-weight compounds' deals with the description of modern concepts and novel approaches to the study of graft copolymers. The long-standing experience of researchers of the Division in the synthesis of photosensitive compounds and their applications in photopolymeric engineering is generalised in the review by V G Syromyatnikov, P A Kondratenko, A Yu Kolendo *et al*., 'Structures, properties and applications of photosensitive organic azides and pentazadienes' to be published in one of the next issues of 'Russian Chemical Reviews'.

The size of this issue cannot encompass the whole range of research carried out at the Department of Chemistry. Therefore, all those who are interested in more detailed information about KNU and the Department of Chemistry are invited to visit our web-sites: http://www.univ.kiev.ua and http://www.chem.univ.kiev.ua

N S Slobodyanik, Corresponding Member
of the National Academy of Sciences of the Ukraine
Dean of the Department of Chemistry of KNU