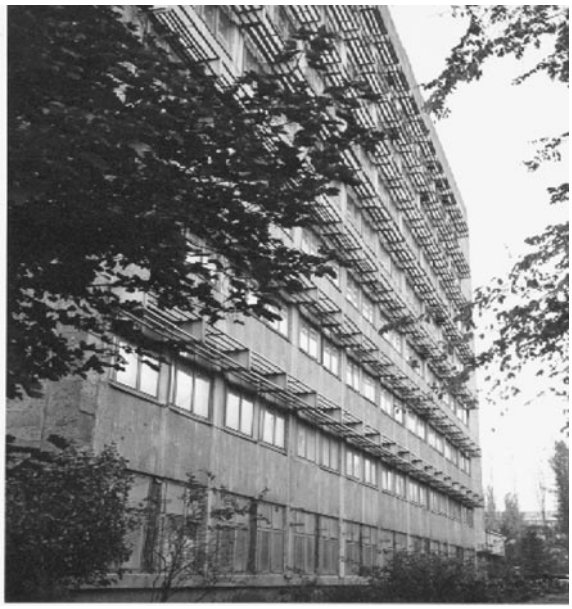
*Russian Chemical Reviews* **71** (11) 867 – 868 (2002) © 2002 Russian Academy of Sciences and Turpion Ltd

# Institute of Physical and Organic Chemistry at the Rostov State University



This issue of the journal is composed of reviews prepared by scientists working at the Research Institute of Physical and Organic Chemistry at the Rostov State University (IPOC). The Institute was founded in 1971 as a subdivision of the North-Caucasian Scientific Centre of Higher School established a year before. The Institute includes six departments and four laboratories. Currently, the staff of the Institute comprises 200 associates, among them there are 14 Doctors of Science and 79 Ph.Ds. The Nuclear Magnetic Resonance Laboratory equipped with Varian spectrometers has the status of a Shared Access Centre of the Russian Foundation for Basic Research (RFBR). For RFBR grant holders from the south of Russia, similar functions are performed by the Laboratory for Quantum Chemistry, which implements the RFBR and Ministry for Industry, Science and Technology projects on computer network development and molecular simulation for higher education institutes in the south of Russia.

Since 1998, the Institute has been under the guidance of the Division of General and Technical Chemistry of the Russian Academy of Sciences (since 2001, the Division of Chemistry and Materials Sciences). This fact, together with the creation of joint laboratories with the Institute of the Problems of Chemical Physics and the Institute of Physical Chemistry of the RAS reflects the tendency towards the closer integration of Russian science and education, which has taken shape in the last decade, as a vital necessity dictated by the development of society. Related to this, an obvious advantage of research institutes affiliated to a university is the absence of departmental or other problems hampering the selection and recruitment of the most gifted students to work on scientific projects. The IPOC actively uses this opportunity in cooperation with the Department of Chemistry of the Rostov State University. The post-graduate course and the facilities for working towards doctorate degree, and the Academic Council for defending Ph.D. and Doctoral theses functioning at the Institute, provide the conditions necessary for raising the scientific level of young scientists.

The main fields of research developed at the Institute are related to fine organic synthesis, photochemistry, the synthesis and study of the properties of metal coordination compounds, structural theory, and the mechanisms of organic reactions.

Of the interesting results of investigations performed at the Institute in recent years, noteworthy is the theoretical development of the principle of structural design of compounds with dynamic molecular behaviour able to undergo reversible low-barrier intramolecular rearrangements. This principle has underlain the targeted synthesis of bi-stable compounds existing as two or several stable forms whose interconversions can be induced by electromagnetic or electric fields. Studies into photocontrolled bi-stable structures have resulted in the development of new types of photochromic and fluorescent systems functioning as abiotic converters of light energy, highly sensitive photochemical chemosensors, effective molecular switches and 3D data recording media (molecular memory).

A traditional field of investigation at the Institute is the synthesis of polycyclic nitrogen- and oxygen-containing heterocycles and monosaccharides. The scientists working at the Institute have received more than 100 patents, including foreign ones, for physiologically active compounds exhibiting more than 50 types of biological activity including antidiabetic, antiaggregant, antiarrhythmic, antiulcer, local anaesthetic, antioxidant and others. Some of these products have already been authorised for clinical trials and the antiarrhythmic drug Ritmidazol has passed these trials and is allowed to be used in clinical practice by the Russian Federation Pharmacological Committee.

The organic ligands synthesised at the Institute serve for the preparation of coordination compounds of transition and non-transition elements with variable polyhedral types of chelate units. Efficient polymerisation catalysts, compounds with valuable magnetic characteristics, UV light converting luminophores, laser dyes, additives to lubricating oils, and so on, have been found among the new metal complexes.

The applied studies carried out at the Institute concentrate on electrochemistry (study of metal corrosion mechanisms, development of effective corrosion inhibitors for drilling tools operating in highly acidic and hydrogen sulfide environments), geochemistry (regional analytic surveys, landscape pollution mapping, analysis of man-caused pollution), development of new compo-

sites, coatings, lubricants and antifriction materials for aerospace and the automotive industry (some materials elaborated at the Institute were used in the spaceshuttle Buran). The process of manufacture of the Drotaverin drug (No-spa analogue) from Russian raw materials developed at the IPOC is currently under industrial development at the Volgograd chemical plant.

During the last 5 years, the scientists working at the Institute have published sixteen scientific monographs (six of them were published by companies in the USA, Germany and the Netherlands) with more than 500 scientific papers published in Russian and other international journals. More than 80 patents were granted, two inventions being patented abroad (in 23 countries). There are three State Prize laureates and a number of A M Butlerov and Alexander von Humboldt Prize winners, and winners of other prizes.

As in other scientific institutions of Russia, the Institute has faced severe financial problems and a shortage of personnel during the last decade. Suffice it to say that today's budgetary financing of the Institute does not exceed 5% of the pre-reform finances (on a comparable price schedule). The scientific potential and the 'critical mass' of the Institute and the intake of young specialists needed for future prospects are maintained almost exclusively by RFBR grants (the Institute has annually 10 to 12 initiative grants, and also leading scientific school grants and grants of the shared access laboratory 'Molecular spectroscopy' and of the library and database electronic access network), grants and programmes of the Ministry of Education and the Ministry for Industry, Science and Technology of the Russian Federation. Of special significance are international programmes and grants from the European Union (INTAS), Civilian Research and Development Foundation (CRDF, USA), Alexander von Humboldt and Volkswagen Stifftung Foundations (Germany), International Science and Technical Centre (ISTC), Council of National Research and Science (CNRS, France), SPECS and BioSPECS companies (Netherlands), the Servier pharmaceutical company (France), *etc*. Other forms of international collaboration and exchange are also used. Research dealing with photochromic and fluorescent chemosensors carried out at the Institute is a part of a Project executed by the Basic Research and Higher Education Centre at the Rostov, Kuban' and Taganrog Radio Engineering Universities financed by the CRDF, the Ministry of Education of the Russian Federation and the administrations of the Rostov Region and Krasnodar Territory. Within the framework of this project, more than 30 students and post-graduates were recruited on a competitive basis to work at the Institute where they received an additional scholarship.

The reviews presented in this issue illustrate the main fields of investigations carried out at the Institute and also some results of the collaboration with Universities in the USA and France. The paper by A D Dubonosov, V A Bren and V A Chernoivanov entitled 'Norbornadiene – quadricyclane as an abiotic system for the storage of solar energy' and the paper by V Lokshin, A Samat (Marseilles University) and A V Metelitsa dealing with the synthesis and photochromic properties of spirooxazines represent the rapidly progressing research into photochemically active systems — molecular switches and optical memory elements, abiotic converters of light energy and fluorescent chemosensors.

The review by Yu A Zhdanov and Yu E Alekseev entitled 'Basic achievements in the coordination chemistry of modified monosaccharides' characterises the new trends in the development of carbohydrate chemistry, in particular, the possibility of preparing effective enantioselective catalysts by chirality transfer from the carbohydrate ligand to the metal centre.

The review by A D Garnovskii and I S Vasil'chenko 'Rational design of metal coordination compounds with azomethine ligands' gives a concentrated survey of the many-year research into targeted synthesis of mono- and polynuclear clelates and molecular complexes with coordination units of the type $MN_xZ_y$ (where Z = NR, O, S, Se, Te), typical of the most important metal enzymes and metal proteins.

An original field of investigation carried out at the Institute is the chemistry of organotellurium compounds. Organotellurium compounds are not only precursors of some efficient semiconductor materials but, owing to specific features of the valence and hypervalent bonds formed by tellurium, they are also useful synthons for the synthesis of new heterocycles; this allows development of a peculiar synthetic strategy. I D Sadekov's review 'β-Telluroacroleins and β-tellurovinyl ketones: synthesis, reactions and structure' is devoted to one of the classes of organotellurium compounds studied at the IPOC.

Finally, the paper by V I Minkin, R M Minyaev, R Hoffmann 'Non-classical structures of organic compounds: unusual stereochemistry and hypercoordination' summarises the main results of investigations in this intriguing field of theoretical chemistry, including the results obtained in cooperation with the group of theorists headed by Nobel Prize winner, a foreign member of the RAS, Roald Hoffmann (Cornell University, USA).

Of course, the size of the issue does not permit all the fields of research carried out at the Institute of Physical and Organic Chemistry to be covered. Additional information concerning the Institute and its personnel can be found at the Institute websites (http://www.ipoc.rsu.ru and http://rec.ipoc.rsu.ru).

The increase in students' interest in scientific research and in the intake of post-graduates and young scientists, which has become evident in recent years, allows one to hope that the studies published in this issue will be continued in future years.

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Director of the Institute
of Physical and Organic Chemistry