

VII Russian Conference on Mechanisms of Catalytic Reactions (with International Participation)

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On July 2–8, 2006, St. Petersburg hosted the VII Russian Conference on Mechanisms of Catalytic Reactions (with international participation), one of Russia's biggest chemical forums. This was followed by the II International Symposium on Carbon in Catalysis (July 11–13). Both forums were held in historical halls of an old mansion on Vasil'evskii Island, in the central part of the city. The mansion was placed at the organizers' disposal by the Presidium of St. Petersburg Research Center, Russian Academy of Science.

The chief organizer of the VII Russian Conference on Mechanisms of Catalytic Reactions was the Boreskov Institute of Catalysis (Siberian Branch, Russian Academy of Sciences). Large contributions to the organization of the conference were made by St. Petersburg Research Center (Russian Academy of Sciences) and Moscow State University. The conference was financially supported by the Russian Foundation for Basic Research, the International Science and Technology Center (ISTC), the LG Chem/Moscow Institute of Technology Commercialization, Sozvezdие Management Company, the Grebenshchikov Institute of Silicate Chemistry (Russian Academy of Sciences), St. Petersburg State University, the St. Petersburg Division of the Mendeleev Russian Chemical Society, and ZAO Spektroskopicheskie Sistemy.

The Russian conferences on mechanisms of catalytic reactions have always gathered numerous specialists from all regions of Russia, the former Soviet republics, and other countries. In recent years, the geography of the forum has further widened. Of the 254 participants of the seventh conference, 34 represented universities and companies of Austria, England, Bulgaria, Hungary, Germany, Israel, Ireland, Finland, France, the Netherlands, Poland, and the United States and 220 were from academic and specialized research institutions, educational institutions, companies, and enterprises of Russia, Ukraine, Kazakhstan, Belarus, and Azerbaijan.

Note that no specialized conference on catalysis has ever been held anywhere in the world. There have been only catalysis sections in the framework of various chemical congresses and symposia. Many reports made by Russian and foreign lecturers invited to this conference could beautify any of those forums.

By tradition, the scientific program of the conference included plenary lectures. There were six plenary

lectures, one per day. Sixteen key lectures were delivered, which were devoted to the most significant recent advances in catalysis. Ninety-three oral reports were made in the framework of three parallel sections, namely, “Heterogeneous Redox Catalysis,” “Heterogeneous Acid–Base and Homogeneous Catalysis,” and “Methods for Investigation of Mechanisms of Catalytic Reactions.” Furthermore, the program of the conference included 12 oral reports by young scientists and 96 poster presentations.

During the conference, ISTC held a seminar entitled “Role of Catalysis in Solving the Problems of Hydrogen Energy and Environmental Protection,” which gathered 45 scientists. Seventeen reports were presented at the seminar, which dealt with the results and prospects of the implementation scientific projects included in the ISTC program.

On the first day of the conference, there was a presentation of the National Zeolite Society.

Each morning session of the conference began with a plenary lecture. The opening lecture was delivered by S.D. Varfolomeev (Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Moscow). It was devoted to enzyme catalysis, an important and rapidly developing area of chemistry. The marked recent progress in this area has been due to use of advanced techniques in the study of the molecular structure of enzymes, including powerful quantum chemical methods. The main focus of the lecture was placed on bioinformatic methods, which enable the researcher to study both the general properties of enzymes and the structure and catalytic mechanisms of active sites using quantum chemical calculations. In particular, the role of glycine in the formation of the 3D structure of the active site was considered and this structure was compared to the structures of the active sites of other enzymes.

C. Mirodatos (Institut de Recherches sur la Catalyse, CNRS, Villeurbanne, France) reported the role of admixtures in the ceria supports of platinum catalysts for three reactions, namely, partial methane oxidation into synthesis gas, selective CO oxidation in the presence of hydrogen, and CO oxidation with water vapor. He presented the results of his studies of catalysts by transition state kinetics methods and DRIFT spectroscopy in operando. These results allowed the active catalyst surface to be described both qualitatively and

quantitatively and provided means of controllable catalyst design.

L. Petrov (Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria) devoted his lecture to the role of minor noble metal admixtures in conventional nickel catalysts for steam methane reforming. These admixtures enhance the selectivity of the catalysts and reduce their coking without significantly raising their cost.

D.Yu. Murzin (Åbo Akademi University, Turku) reported the $\text{Ag}/\text{Al}_2\text{O}_3$ system as the most active and stable catalysts for selective NO_x reduction with hydrocarbons. The main focus of his lecture was on the preparation and properties of catalysts and on reaction mechanisms and kinetics.

The lecture by C. Hardacre (School of Chemistry and Chemical Engineering, Queen's University, Belfast, United Kingdom) was devoted to catalysis in ionic liquids, a poorly studied field of chemistry. The lecturer reported a variety of reactions that can take place both under homogeneous conditions and on heterogeneous catalysts. It was demonstrated that, in three-phase systems, ionic liquids are highly selective solvents.

I.V. Koptyug (International Tomography Center, Siberian Branch, Russian Academy of Sciences, Novosibirsk) presented a rapidly developing, nondestructive, tomographic method for investigation of three-phase reactions, filtration, drying, and adsorption of various substances.

The first key lecture was delivered by A. Bell (Department of Chemical Engineering, University of California, California, United States). Devoted to hydrocarbon oxidation kinetics, it gave young researchers an example of methodologically correct investigation of catalytic mechanisms. Bell reported the effects of the structure and composition of active sites on the kinetics and mechanism of hydrocarbon oxidation, focusing on the experimental and theoretical investigation of catalysts containing isolated sites. By way of example, the lecturer considered monomeric metal oxide particles on an oxide support, heteropolyacids, and soluble organometallic complexes. He discussed methane oxidation on isolated molybdenum and iron oxide sites in the zeolite structure and cyclooctene epoxidation on iron porphyrites.

The key lecture by K. Seshan (University of Twente, Enschede, the Netherlands) dealt with the synthesis of C_2 and C_3 olefins by partial propane oxidation over Li/MgO catalysts. He considered the heterogeneous-homogeneous mechanism of the oxidative dehydrogenation and cracking of propane.

A.E. Gekhman (Kurnakov Institute of General and Inorganic Chemistry, Russian Academy of Sciences, Moscow) considered alternative hypothetical mechanisms of peroxidation. He reported the effects of substituents, ligands, and intramolecular hydrogen bonding in active oxidizers on the kinetics of decomposition, epoxidation, hydroxylation, and singlet dioxygen transfer.

V.V. Azatyan (Institute of Structural Macrokinetics and Materials Science Problems, Russian Academy of Sciences, Chernogolovka, Moscow oblast) presented a study of fast reactions that he discovered in catalytic combustion. Furthermore, he reported free atoms and radicals adsorbed from the gas phase that give rise to heterogeneous chain propagation and chemically modify the surface.

Z.R. Ismagilov (Boreskov Institute of Catalysis, Siberian Branch, Russian Academy of Sciences, Novosibirsk) suggested new catalysts based on uranium oxides. The catalytic properties of bulk and supported uranium oxides were tested in methane and butane oxidations, methane reforming, methane dehydroaromatization, and the oxidation of chlorinated hydrocarbons. The results of characterization of these catalysts by various physicochemical methods were presented.

G.I. Koldobskii (St. Petersburg State Technical University) gave numerous examples of successfully applying phase transfer catalysis to the synthesis of heterocyclic compounds that are difficult or even impossible to obtain otherwise.

I.V. Kozhevnikov (Department of Chemistry, University of Liverpool, United Kingdom) presented his systematic study of a wide class of heterogeneous catalysts based on heteropolyacids.

P. Tundo (Department of Environmental Science, Ca' Foscari University, Venice, Italy) focused on acid-base catalysis in the chemistry of dimethyl carbonate as the an alternative methylating agent.

S.S. Ivanchev (St. Petersburg Branch, Boreskov Institute of Catalysis) reported the kinetics and mechanism of ethylene polymerization on postmetallocene catalytic systems, as well as the structural and molecular-weight parameters of the resulting polymers determined by a variety of methods. Special attention was given to the kinetic features of ethylene polymerization catalyzed by methylalumininoxane-activated two-component bimetallic systems.

E.P. Talsi (Boreskov Institute of Catalysis, Novosibirsk) studied the key intermediates involved in olefin polymerization on metallocene and postmetallocene catalysts. He considered methylalumininoxane as a catalyst for this reaction.

Particular attention of the audience was attracted by the key lecture by V.B. Kazanskii (Zelinskii Institute of Organic Chemistry, Russian Academy of Sciences, Moscow), who reported a new spectral criterion for the chemical activation of adsorbed molecules in heterogeneous catalysis. The results reported by Kazanskii provide a better understanding of the selectivity of acid-catalyzed reactions on the atomic-molecular level.

Considerable interest was evoked by the lecture by A.G. Stepanov (Boreskov Institute of Catalysis, Novosibirsk), which was devoted to applying NMR spectroscopy to reactions occurring on zeolites in a wide temperature range.

V.I. Bukhtiyarov (Boreskov Institute of Catalysis, Novosibirsk) reported the use of in situ surface examination methods in the elucidation of mechanisms of heterogeneous catalytic reactions. The novelty of his approach to the investigation of catalytic mechanisms under near-real conditions is that determination of the most important surface characteristics is coupled with mass spectrometric or gas chromatographic estimation of catalytic activity and selectivity. The efficiency of this approach was illustrated by the examples of CO oxidation on the platinum surface, partial methane oxidation into formaldehyde on copper, methanol decomposition on palladium, and ethylene peroxidation on silver. These reactions generate reactive intermediates that do not form in a high vacuum. This finding considerably modifies the conventional views of catalytic mechanisms.

V.A. Matyshak (Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow) reported a study of the surface steps of heterogeneous catalytic reactions by a spectrokinetic method. The essence of this method is that FTIR characterization of surface compounds is performed simultaneously with product formation rate measurements.

S.A. Kukushkin (Institute of Problems in Machine Science, Russian Academy of Sciences, St. Petersburg) devoted his lecture to mechanisms of the formation and evolution of catalytic nanostructures under the action of chemical, physical, and mechanical factors. He suggested a new, perturbation-theoretic approach to the description of the nucleation of multicomponent and multiphase nanostructures.

The oral reports presented by collectives of authors in the framework of three parallel sections were an important part of the scientific program of the conference (these presentations will be referred to by citing the reporter's name).

Section 1: Heterogeneous redox catalysis. N.V. Brevova (Mendeleev University of Chemical Technology, Moscow) presented an isotope-exchange study of the interaction between CO and the surfaces of oxide and cement catalysts. V.V. Ordonskii (Moscow State University, Moscow) reported the mechanism of alkane conversion on Zn-containing zeolites deduced from kinetic and spectroscopic data. He found that the introduction of zinc into a zeolite increases the contributions from dehydrogenation and aromatization to the conversion of all hydrocarbons. D.Yu. Murzin (Åbo Akademi University, Turku) reported the catalytic pyrolysis of low-density polyethylene on the microporous and mesoporous zeolites HZSM-5, HMCM-22, and HMCM-41. N.A. Gaidai (Zelinskii Institute of Organic Chemistry, Moscow) reported the mechanism of carbon dioxide hydrogenation on copper and nickel catalysts. O.V. Vodyakina (Tomsk State University) reported silver and gold nanoparticle organization in sol-gel silicate matrices as a new approach to the synthesis of highly efficient oxidation catalysts. L. Petrov (Institute

of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria) considered the effect of nickel on the state of components and on the hydrodesulfurization activity of alumina-supported polyoxotungstates. S. Preis (Lappeenranta University of Technology, Lappeenranta, Finland) reported the results of collaboration between Lappeenranta University and the Boreskov Institute of Catalysis in the field of emission and effluent control. Yu.M. Serov (Peoples' Friendship University of Russia) reported the hydrogenation of a mixture of carbon oxides at atmospheric pressure. The report by A.N. Startseva (Boreskov Institute of Catalysis, Novosibirsk) dealt with the room-temperature decomposition of hydrogen sulfide into hydrogen and elementary sulfur on solid sulfide catalysts placed into a solvent layer, a new catalytic reaction. V. Matveeva (Tver State Technical University, Tver) presented data concerning the mechanisms of redox reactions, namely, the selective oxidation of the hydroxo, keto, and aldehyde groups and the selective hydrogenation of unsaturated hydrocarbons on monometallic and bimetallic catalysts based on polymer nanocomposites. V.V. Chesnokov (Boreskov Institute of Catalysis, Novosibirsk) considered palladium supported on three different carbon materials to illustrate the effect of the support structure on the state of the metal and on its catalytic properties in the selective hydrogenation of butadiene and acetylene. The report by A. Aboukaïs (Université du Littoral-Côte d'Opale, Dunkerque, France) was devoted to the correlation between the oxidation state of Ru supported on CeO₂ and the catalytic activity of ruthenium in propylene and coke oxidation in the context of the catalyst deactivation problem. I. Borbath (Institute of Surface Chemistry and Catalysis, Budapest, Hungary) considered low-temperature CO oxidation over tin-modified Pt/SiO₂. L.G. Pinaeva (Boreskov Institute of Catalysis, Novosibirsk) reported the effect of oxygen mobility in platinum catalysts supported on the CeO₂-ZrO₂ solid solution on the kinetics of methane conversion into total and partial oxidation products at short contact times. N.M. Popova (Sokol'skii Institute of Organic Catalysis and Electrochemistry, Almaty, Kazakhstan) reported a Ni-Cu-Cr catalyst for selective methane oxidation into synthesis gas. M.A. Kipnis (Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences, Moscow) considered the specific features of CO oxidation on the igniting surface of a Ru/Al₂O₃ catalyst. E.M. Slavinskaya (Boreskov Institute of Catalysis, Novosibirsk) reported the state of the active component in Pd/CeO₂-Al₂O₃ catalysts involved in CO oxidation. P.V. Snytnikov (Boreskov Institute of Catalysis, Novosibirsk) described the catalytic properties of copper-cerium oxide systems in methanol and dimethyl ether steam reforming and in CO removal from hydrogen. N.A. Pakhomov (Boreskov Institute of Catalysis, Novosibirsk) considered the mechanisms of methane chlorination and 1,2-dichloroethane dehydrochlorination on nanodisperse MgO, Al₂O₃, and TiO₂. E.V. Golubina (Moscow State University, Moscow)

reported the effect of a second metal (Fe, Ni, Cu, Co) on the properties of supported Pd-containing catalysts in hydrodechlorination reactions. S.A. Kachevskii presented a kind of logical continuation of Golubina's study. He reported the activity and deactivation of Pd-containing hydrodechlorination catalysts supported on ultrafine diamond. A.N. Chudinov (Institute of Technical Chemistry, Ural Division, Russian Academy of Sciences, Perm) considered the mechanism of the chlorine formation step of the oxidation of chlorine-containing organic compounds on molten catalysts. In her second report, E.V. Golubina (Moscow State University, Moscow) described the effect of strong metal-support interaction on the catalytic activity of the Pd-ZrO₂-Al₂O₃ system in chlorobenzene hydrodechlorination. M.R. Flid (Sintez Research and Engineering Center, Moscow) considered reactions of chlorinated organic compounds, specifically, the theoretical and applied aspects of ethylene oxychlorination on CuCl₂/Al₂O₃ catalysts. A.A. Khasin (Boreskov Institute of Catalysis, Novosibirsk) pointed out the problem of strong nickel-support interaction in philloaluminosilicate-supported catalysts during their oxidizing or reducing treatment. A. Khodakov (Laboratoire de Catalyse de Lille, Villeneuve d'Ascq, France) put forward two methods for investigating the elementary steps of Fischer-Tropsch synthesis on cobalt catalysts, namely, transition-state kinetic measurements in a pulsed reactor and modeling of the steady state of the catalyst. O.P. Saul (OAO MMK, Magnitogorsk) reported the use of catalysts in the decomposition of coke-oven ammonia. T.N. Burdeinaya (Topchiev Institute of Petrochemical Synthesis, Moscow) reported the mechanism of selective NO_x reduction with propane on a Ni-Cr oxide catalyst. V.S. Rudnev (Institute of Chemistry, Far East Branch, Russian Academy of Sciences, Vladivostok) described zirconium-containing oxide coatings on titanium obtained by plasma electrolytic oxidation. M.N. Simonov (Boreskov Institute of Catalysis, Novosibirsk) reported the activity of copper-containing catalysts in lactic acid hydrogenation.

Section 2: Heterogeneous acid-base and homogeneous catalysis. The oral report session in this section was opened by N.V. Belkova (Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Moscow), who considered proton transfer reactions in transition metal hydride chemistry. N.K. Skvortsov (St. Petersburg Technological Institute) presented a mechanistic study of hydroxylation catalyzed by platinum, palladium, and rhodium complexes. F.K. Shmidt (Irkutsk State University) described the mechanism of the formation of hydrogenation catalysts based on palladium phosphine complexes, using palladium β -diketonate complexes as an example. E. Gebauer-Henke (Institute of General and Ecological Chemistry, Łódź, Poland) reported the catalytic and physicochemical properties of Pt/ α -GeO₂ catalytic systems in the selective hydrogenation of α , β -

unsaturated aldehydes. A.P. Brodskii (Sokol'skii Institute of Organic Catalysis and Electrochemistry, Almaty, Kazakhstan) elucidated the mechanism of *n*-hexane conversion on zeolite-promoted Fe-Pt-Mo/Al₂O₃ catalysts. S. Karski (Technical University of Łódź, Poland) presented kinetic data for the hydrogenation of aqueous nitrate solutions on alumina-supported Rh and Rh-Cu catalysts. V.M. Kogan (Zelinskii Institute of Organic Chemistry, Moscow) described the mechanism of the hydrogenation of S-containing compounds on transition metal sulfides. A.V. Lavrenov (Institute of Hydrocarbon Processing, Siberian Branch, Russian Academy of Sciences, Omsk) discussed the deactivation of zirconium sulfate catalysts for isobutane alkylation with butenes. K.P. Brylyakov (Boreskov Institute of Catalysis, Novosibirsk) reported the latest advances in asymmetric sulfoxidation on metal catalysts. G.G. Volkova (Boreskov Institute of Catalysis, Novosibirsk) reported the halogenless carbonylation of dimethyl ether and the superacidic and catalytic properties of Rh/Cs_xH_{3-x}PW₁₂O₄₀ systems. One report by E.G. Zhizhina (Boreskov Institute of Catalysis, Novosibirsk) was devoted to the mechanism of liquid-phase *n*-butene oxidation into methyl ethyl ketone catalyzed by aqueous solutions of a palladium(II) complex of a Mo-V-P heteropolyacid. A. Khenkin (Weizmann Institute of Science, Rehovot, Israel) reported the mechanism of the catalytic oxidation of organic compounds on poly-oxophosphomolybdates. Z.P. Pai reported the oxidative functionalization of unsaturated hydrocarbons using a phase-transfer catalysis technique involving peroxy-polyoxotungstate-based catalysts. In her second report, Zhizhina (Boreskov Institute of Catalysis, Novosibirsk) suggested employing Mo-V-P heteropolyacids as catalysts in the synthesis of vitamins E and K, which play a significant role in the vital functions of the human organism and are widely used in medicine. E.G. Chepaikin (Institute of Structural Macrokinetics and Materials Science Problems, Chernogolovka, Moscow oblast) described the mechanisms of the activation and functionalization of saturated hydrocarbons on rhodium-containing catalytic systems in the presence of oxygen and reducing agents. E.V. Starodubtseva (Zelinskii Institute of Organic Chemistry, Moscow) reported the asymmetric deuteration of methyl levulinate in protic solvents in the presence of the catalytic system Ru(II)-(S)-BINAP-HCl. R. Poli (l'Université Paul Sabatier et à l'Institut National Polytechnique de Toulouse, Toulouse, France) reported the asymmetric hydrogenation of ketones catalyzed by chiral planar iridium complexes with phosphine and thioether ligands. E.M. Evstigneeva (Lomonosov State Academy of Fine Chemical Technology, Moscow) reported the catalytic allylation of oxo and aza derivatives of norbornene. This unordinary reaction is catalyzed by nickel and palladium complexes with organophosphorus ligands. V.V. Molchanov (Boreskov Institute of Catalysis, Novosibirsk)

reported the catalytic properties of ammonia in the mechanochemical synthesis of a magnesium intermetallic hydride. L.V. Petrov (Institute of Chemical Physics, Russian Academy of Sciences, Chernogolovka, Moscow oblast) described the kinetics and mechanism of styrene epoxide oxidation with dioxygen in the presence of *p*-toluenesulfonic acid as the catalyst. I.L. Simakova (Boreskov Institute of Catalysis, Novosibirsk) reported α -oxypropionic acid reduction into propylene glycol on a reduced copper-containing catalyst. A. Travert (Laboratoire Catalyse et Spectrochimie, UMR CNRS-ENSICAEN, Caen, France) reported that the sulfur content of catalytic cracking gasoline can be reduced by introducing certain admixtures into the Zn/Al₂O₃ catalyst. O.P. Pestunova (Boreskov Institute of Catalysis, Novosibirsk) elucidated the autocatalytic mechanism of formaldehyde polymerization into monosaccharides (Butlerov reaction) in aqueous alkali. V.R. Flid (Lomonosov State Academy of Fine Chemical Technology, Moscow) suggested new heterogenized nickel catalysts for codimerization between norbornene and functionalized alkenes. The report by I.M. Davletbaeva (Kazan State Technological University, Institute of Polymers, Kazan) dealt with the anionic polymerization of aromatic isocyanates. E.A. Mushina (Topchiev Institute of Petrochemical Synthesis, Moscow) devoted her report to titanium-magnesium catalysts used in olefin and diene polymerization. It was discovered that these catalysts in combination with a trialkylaluminum are very active in the *trans*-polymerization of butadiene and isoprene and their copolymerization. N.N. Sigaeva (Institute of Organic Chemistry, Ufa Scientific Center, Russian Academy of Sciences, Ufa) focused her report on the kinetic heterogeneity of the active sites of titanium-containing ion-coordination catalytic systems in isoprene polymerization. O.N. Tsvetkov (Research Institute of Oil Processing, Moscow) considered the mechanisms of the cationic polymerization of higher α -olefins. G.P. Belova (Institute of Chemical Physics, Chernogolovka, Moscow oblast) reported the kinetics and mechanism of the homogeneous catalytic synthesis of low- and high-molecular-weight copolymers of carbon monoxide, olefins, and/or dienes.

Section 3: Methods for Investigation of Mechanisms of Catalytic Reactions. A. Vimont (CNRS-ENSICAEN-Université de Caen, France) discussed the problem of the deactivation of zeolite catalysts in the acetylation of aromatic compounds with acetaldehyde and reported a study of this process by IR spectroscopy in *operando*. I.K. Vorontsova (Karpov Research Institute of Physical Chemistry, Moscow) pointed out the role of the near-surface electric crystal field of oxides in the formation of the electronic and chemical properties of surface structures. In this context, she considered the energy parameters of the adsorption of a number of small molecules and the electronic and magnetic resonance properties of the radical anion O_{*n*}⁻ on the surface

of ideal cubic ionic crystals of the MgO type. I.G. Danilova (Boreskov Institute of Catalysis, Novosibirsk) reported the use of *in situ* IR spectroscopy in the investigation of the adsorption and high-temperature reactions of hydrocarbons on the surface of oxide and zeolite catalysts in the presence of molecular water and air under real conditions. A.O. Kushko (Kiev Polytechnical Institute, Kiev, Ukraine) presented a DFT analysis of the mechanism of the asymmetric reduction of ketones in the presence of chiral adamantane-containing 1,3,2-oxazaborolidines as catalysts. The second report by the same author was devoted to quantum chemical analysis of the thermodynamics of N-, O-, and N,O-complexation between bicyclic 1,3,2-oxazaborolidines and borane. A.A. Tsyganenko (Fock Institute of Physics, St. Petersburg State University, St. Petersburg) demonstrated that, in the framework of the electrostatic model, the integrated adsorption coefficient of CO is lower for the molecules bound to the cation through the carbon atom and is higher for the molecules adsorbed through the oxygen atom. V.I. Avdeev (Boreskov Institute of Catalysis, Novosibirsk) reported the DFT-calculated mechanism of 1,2-dichloroethane dechlorination on Cu and Cu-Pt catalysts. The reaction mechanism was found to be the same in both cases in spite of the large difference between the reaction rates. It was, therefore, assumed that the rate-limiting step of the reaction on the Cu catalyst is hydrogen activation. L.N. Shachenkova (Institute of Physicoorganic Chemistry, Belarussian Academy of Sciences, Minsk) reported the catalytic activities of FIBAN K-1 sulfonate cation exchanger samples with different extents of hydration in the synthesis of methyl *tert*-amyl ether. S. Beloshapkin (University of Limerick, Ireland) presented *in situ* XPS and NEXAFS studies of a vanadium-phosphorus oxide catalyst for selective oxidation of *n*-butane into maleic aldehyde. Vovk considered the stability of gold nanoparticles in the model systems Au/Al₂O₃ and Au/Fe₂O₃ involved in CO oxidation and demonstrated that Au/Al₂O₃ is thermally much more stable than Au/Fe₂O₃. The central idea of the report by V.V. Gorodetskii (Boreskov Institute of Catalysis, Novosibirsk) was that the fundamental property of oscillatory heterogeneous catalytic reactions on platinum-group metals is self-organization through the formation of mobile waves as large as hundreds of angstroms on the active surfaces. V.V. Kaichev presented *in situ* XPS and mass spectrometric studies of the mechanism of palladium-catalyzed methanol conversion. He demonstrated that one of the causes of the low catalytic activity of palladium in low-temperature methanol conversion is the formation of carbon. A.I. Boronin (Boreskov Institute of Catalysis, Novosibirsk) presented an XPS and TPD study of the adsorption states of oxygen on the polycrystalline gold surface. He reported the detailed kinetics of the interaction of adsorbed oxygen as a 2D oxide with CO, ethylene, and hydrogen. A.V. Matveev (Boreskov Institute of Catalysis, Novosibirsk) described the mechanism of

ammonia oxidation on single crystals of platinum-group metals. A.V. Nartova (Boreskov Institute of Catalysis, Novosibirsk) reported a scanning tunneling microscopic and XPS study of Pt/Al₂O₃ model catalysts obtained by methods of preparative chemistry. She demonstrated, for the first time, the applicability of scanning tunneling microscopy to the examination of model catalysts obtained under real conditions using conducting and thermally stable supports. A.V. Porsin (Ural Electrochemical Integrated Plant, Novouralsk) reported the oxygen storage capacity of Ce_xMyO₂ determined by TPR and CO oxidation. I.P. Prosvirin (Boreskov Institute of Catalysis, Novosibirsk) demonstrated by the example of copper-catalyzed methanol oxidation into formaldehyde that recording X-ray photoelectron spectra of the gas phase in situ is a promising means of evaluating the catalytic properties (conversion and selectivity) of heterogeneous catalysts. Smirnov (Boreskov Institute of Catalysis, Novosibirsk) reported the mechanism of the reaction NO + H₂ on the Pt(100)-hex surface under conditions of nonuniform spatial distribution of reacting species. This mechanism was elucidated using the high-resolution electron energy loss spectroscopy and temperature-programmed reaction methods. V.F. Tret'yakov (Topchiev Institute of Petrochemical Synthesis, Moscow) reported the nature of synergism in selective NO_x reduction with propane on a mechanical mixture of the Ni–Cr and NTK-10-1 commercial oxide catalysts and the mechanism of this reaction. T. Maniecki (Politechnika Łódzka Institut Chemii Ogólnej i Ekologicznej, Łódź, Poland) considered the conversion of the active phase on the surface of the supported catalyst N–Au/Al₂O₃ during partial methane oxidation into synthesis gas. It was demonstrated that gold improves both the activity and the stability of the nickel catalyst. E.M. Sadovskaya (Boreskov Institute of Catalysis, Novosibirsk) described the mechanism of selective nitrogen oxide reduction with methane on Co-ZSM-5 and fiberglass catalysts. She reported very promising results obtained with new catalysts supported on aluminosilicate fiberglass. M.Yu. Sinev (Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow) demonstrated how the microkinetic approach and mass transfer can be used to achieve efficient conversion of light alkanes in organized catalytic beds. The basic idea of this approach is that, in the simplest case, the bed should consist of two zones. In the first zone, the alkane should be activated to yield free alkyl radicals; in the second, these radicals should be selectively converted to the desired products. M.M. Slin'ko (Semenov Institute of Chemical Physics, Moscow) presented a mathematical model of thermokinetic oscillations in methane oxidation on nickel catalysts. P.A. Chernavskii (Moscow State University, Moscow) reported the use of in situ magnetic methods in the investigation of supported iron-family metal catalysts. The essence of these methods is measuring the magnetic properties of catalysts in a controlled gas

medium in a wide temperature range. A.A. Lysova (International Tomography Center, Novosibirsk) reported the use of image reconstruction techniques based on multinuclear and solid-state NMR in catalysis and related areas. These methods were applied for the first time to heat and mass transfer in exothermic three-phase catalytic processes. V.I. Elokhin (Boreskov Institute of Catalysis, Novosibirsk) reported the stochastic simulation of adsorption and reactions on supported metal nanoparticles. The author used a statistical lattice model imitating physicochemical processes on supported catalyst particles. V.F. Kharlamov (Orel State Technical University, Orel) described methods of investigation of molecule stabilization mechanisms during heterogeneous reactions at the solid/gas interface. The new relaxation method presented by the reporter is based on simultaneous registration of the dynamic effect of the reaction and the concentration of adsorbed gas molecules. A.E. Kuz'min (Topchiev Institute of Petrochemical Synthesis, Moscow) reported empirical calculations of the energies of CO and CH₃ adsorption on nonideal metal surfaces. A.V. Myshlyavtsev (Institute of Hydrocarbon Processing, Omsk) considered self-oscillations in reactions proceeding via the Langmuir–Hinshelwood mechanism.

Note that this, seventh, conference was the first to organize a young scientists section. The reports to be included in this section were selected by the Scientific Youth Council. Two of the 12 participants of this section were awarded the Organizing Committee's Prize for the most interesting research. A.E. Koklin (Zelinskii Institute of Organic Chemistry, Moscow), one of the prize winners, reported *n*-pentane isomerization under supercritical conditions on solid-acid catalysts in the absence of hydrogen or solvents. It was demonstrated that the catalysts are more active and have a much longer service life under supercritical conditions than in the gas phase. The other prize winner, T. Malygina (Lappeenranta University of Technology, Lappeenranta, Finland), reported the photocatalytic oxidation of estrogens, which are very toxic unexcreted compounds damaging the endocrine system. It was demonstrated that TiO₂ dispersions in alkali are the most effective photocatalysts.

At the closing meeting of the VII Russian Conference on Mechanisms of Catalytic Reactions, the participants expressed their common opinion that the conference had been informative and helpful and had revealed new trends in nearly all areas of redox, heterogeneous acid–base, and homogeneous catalysis. It was particularly noted that many reporters presented a review summing up long-term systematic research carried out by scientific schools in the field of catalysis. Considerable attention was given to the use of various instrumental methods in catalyst characterization and mechanistic studies in situ. This area was the subject of one of the sections of the conference.

It was noted that the conferences on mechanisms of catalytic reactions, which had been regularly held since 1974, had contributed to the progress of the Russian school of catalysis. The seventh conference not only gave the participants valuable scientific information, but also determined the most important future collaboration strategies.

Taking into account the increasing interest in the Russian conferences on mechanisms of catalytic reactions, the participants approved the decision to hold the eighth forum in 3 years as an international conference under the aegis of the European Federation of Catalysis Societies (EFCATS). The working language of the eighth conference will be English. Submitted materials will be more thoroughly checked for being within the scope of the conference. The main subject of the conference will be mechanisms of catalytic reactions, not catalyst design or synthesis. Considering that the Russian conference on the scientific foundations of catalyst preparation and deactivation problems, another specialized conference on catalysis, is also organized by the Boreskov Institute of Catalysis, it is essential that the organizers should separate these two forums in time and prevent the overlapping of their scopes.

In order to enhance cooperation between fundamental and applied catalysis, the conference suggested that the organizers and the Scientific Council on Catalysis (Division of Chemistry and Materials Science, Russian Academy of Sciences) organize and carry out a Russian congress (conference) on catalysis with the wide participation of the Russian scientific community and industry. The main purpose of this congress should be the presentation and discussion of both theoretical studies and R & D works aimed at new commercial catalysts and catalytic processes.

Although the participants of the conference were working hard, they found time to acquaint themselves with St. Petersburg, the city of 100 museums, one of the most beautiful places in Russia. They made a general tour of the State Hermitage Museum and visited St. Petersburg's famous suburbs, including the Great Peterhof Palace, the Lower Park, the monumental cascades of fountains of the Peterhof State Museum Reserve, and Catherine's Palace in the State Museum Tsarskoe Selo.

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