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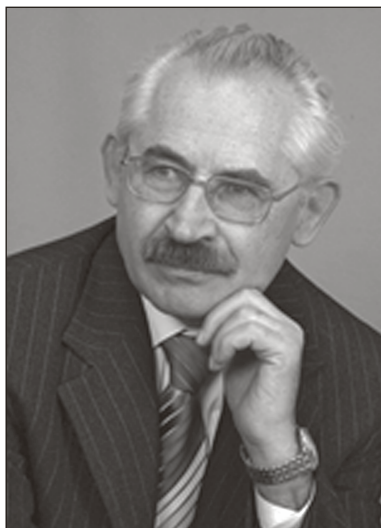
L.M. Litvinenko Institute of Physical, Organic and Coal Chemistry, the NAS of Ukraine, Kyiv

TASKS, ACHIEVEMENTS, AND PROSPECTS OF THE L.M. LITVINENKO INSTITUTE OF PHYSICAL, ORGANIC AND COAL CHEMISTRY OF THE NAS OF UKRAINE



Brief history of the L.M. Litvinenko Institute of Physical, Organic and Coal Chemistry of the NAS of Ukraine (IPOCC) has been described. The basic research activities, the most significant fundamental achievements of the Institute, and the most important applied tasks have been reviewed. The IPOCC contribution to the determination of the reasons of man-made environmental catastrophes and the development of methods for their prevention and remedy has been outlined. The IPOCC challenges and prospects under current conditions have been analyzed.

Keywords: anniversary, physical and organic chemistry, coal chemistry, and synthesis of heterocyclic compounds.



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This year, the scientific community of Ukraine celebrates 50th anniversary of the establishment of Donetsk research center to which the L.M. Litvinenko Institute of Physical, Organic and Coal Chemistry of the NAS of Ukraine (IPOCC) is

incorporated. The history of Institute started with the creation of laboratory at the Galkin Institute of Physics and Engineering which in 1966 was transformed into the Donetsk Department of Physics and Organic chemistry of Pysarzhevskiy Institute of Physical Chemistry of the Academy of Sciences of the Ukrainian SSR and later, in 1975, into the Institute of Physical, Organic and Coal Chemistry of the AS of Ukrainian SSR. In 1990, the Institute was awarded with the name of its founder and first director, Full Member of the AS of Ukrainian SSR L.M. Litvinenko (1921–1983).

At the end of 2014, the Institute had 9 research departments and 250 employees, including 180 researchers (among them, there are 1 Full Member and 1 Corresponding Member of the NAS of Ukraine, 13 Doctors of Sciences, and 92 Candidates of Sciences). Four researchers have been awarded with State Prizes of Ukraine in the sphere of Science and Engineering, 10 employees have been awarded with Pysarzhevskiy, Kiprianov, and Brodskiy Prizes of the NAS of Ukraine. The leading researchers of the Institute have got title of

honorary master of science and engineering and been members to industrial academies and international associations.

Under the Institute, there is a specialized scientific board for examination of Doctor's and Candidate's theses in organic chemistry, physical chemistry, petroleum chemistry, and coal chemistry. The Institute record has counted 26 Doctors and over 200 Candidates of Science.

The main objectives of the Institute are as follows:

- ✦ To make fundamental research for studying the mechanisms of organic compound reactions, including those taking place under homogenous, micellar, and transphase catalysis, as well as the reactivity of molecules and intermediary particles in these processes;
- ✦ To synthesize and to study structure and properties of heterocyclic compounds, including the biologically active ones;
- ✦ To study chemical and physical properties of coal and its components for developing methods of efficient use of coal and products of its processing;
- ✦ To train researchers of highest qualifications.

The Institute schools in the field of organic compound reactivity in nucleophilic, electrophilic, and radical processes; chemistry and chemical thermodynamics of solution; and synthetic chemistry of heterocyclic compounds are highly reputable in Ukraine and all over the globe.

During a certain period, according to decision of the Government Committee for Science and Engineering and AS of USSR, the Institute was one of two leading Ukrainian institutes dealing with coal chemistry that was a priority direction and nowadays, is the leading research institute of Ukraine in this field.

The results of the Institute fundamental researches have been acknowledged all over the world. The Institute coordinates the coal chemistry research by teams from Ukraine, Russia, France, Poland, Bulgaria and is the leader of research in the sphere of organic homogeneous and interphase catalysis and problems of rocket fuel oxidizer waste

management within the framework of the Government program for the management of wastes of liquid rocket fuel and other toxic liquids.

The most important achievements of the Institute are as follows:

- ✦ New structural phenomenon of organic chemistry (positive bridge effect) has been discovered; the basic principles of theory of nucleophilic replacement with different electrophilic centers have been developed;
- ✦ Theory of reaction ability of organic compounds in reaction of nucleophilic and electrophilic replacement, as well as radical oxidation, including those taking place under homogeneous (bi-functional, nucleophilic and micro-heterogeneous (interphase, micellar) catalysis has been elaborated;
- ✦ Original methods for synthesis of heterocyclic compounds have been designed;
- ✦ Mechanisms for metal complex and oxidizing activation of saturated hydrocarbons have been established;
- ✦ Kinetic theory of radical reactions in multicomponent systems and methods for oxygen-containing monomers for the synthesis of very pure materials used in electronic industry have been designed;
- ✦ Media for silver free record of information have been created;
- ✦ A new model for structure of coal organic mass as molecular associate has been developed;
- ✦ Theoretical principles for preventing self-ignition of coal have been elaborated and recommendations for preventing fire at coal mines have been prepared;
- ✦ Corrosion inhibitors and protective coatings for oil-, gas-, and coal extraction equipment based on products and wastes of coke and chemical factories have been designed;
- ✦ Techniques for obtaining graphite capable of thermal expansion have been developed and fire-proof material based on them have been created;
- ✦ Methods for synthesis of medical and veterinary products, fertilizers have been proposed;

✦ Effective water proofing agents for underground and underwater structures have been created.

On the basis of fundamental research results of the Institute, the following important applied problems have been solved:

- ✦ Methods for the synthesis and techniques for obtaining new substances and materials (including low-combustible, thermal and fire-resistant, structurally colored, water-soluble polymers, highly efficient components of adhesives, sealants, film and photographic materials; pharmaceutical and veterinary products, chemical pesticides; technologies for manufacturing epoxy resins for electronic, electrical and radio industry, as well as silver-free information recording media);
- ✦ Effective sorbents, sealants for underground and underwater structures;
- ✦ High-temperature media, corrosion inhibitors, biologically active compounds, as well as compounds for solving calculus in kidneys of patients having kidney stone disease;
- ✦ Solutions for detoxification of phosphorus-containing poisonous substances like GB gas, GD gas, etc.

The Institute has contributed to the study of causes of industrial accidents and man-made catastrophes and the development of methods for their prevention and remedy. The researchers were engaged in identifying the causes of poisoning of miners at Gorlivka *Olexander-Zakhid* mine and mass poisoning of inhabitants of Pershotravnevyi District (Mykolaiv Oblast), in summer 2000.

The Institute has engaged a team of highly-qualified experts in chemistry who are capable of solving sophisticated theoretical and applied problems.

Nowadays, in connection with ATO in Donbas Region, pursuant to the Resolution of the Presi-

dium of the NAS of Ukraine of 21.11.2014, no.709 on the Location of Institutions of the NAS of Ukraine the Institute staff was moved from Donetsk and Kyiv (address: 50 Kharkivske Highway, 02160, Kyiv, the building of the Institute for bioorganic Chemistry and Petroleum Chemistry of the NAS of Ukraine), where the Institute occupies an area of 150 m² for administrative services. In the Institute of High Molecular Weight Compounds of the NAS of Ukraine, the Institute has a 300 m² laboratory space. As of today, the Institute personnel has counted 109 employees, including 92 researchers (including 1 Full member of the NAS of Ukraine, 11 Doctors, and 50 Candidates of Science), has 4 departments and support units. Despite the lack of comfortable working conditions the Institute researchers continue to fulfill its assignments in close cooperation with academic institutes in the field of chemistry who have kindly provided access to their laboratory facilities.

On this occasion, I would like, on behalf of myself and the Institute relocated staff, to thank *V.D. Pokhodenko* and *V.G. Koshechko*, Full Members of the NAS of Ukraine (Pysarzhevskiyi Institute of Physical Chemistry, the NAS of Ukraine), *V.P. Kukhar*, Full Member of the NAS of Ukraine, and *A.I. Vovk*, Corresponding Member of the NAS of Ukraine (Institute of Bioorganic Chemistry and Petroleum Chemistry, the NAS of Ukraine), *M.T. Kartel*, Full Member of the NAS of Ukraine (Chuiko Institute of Surface Chemistry, the NAS of Ukraine), *V.I. Kalchenko*, Corresponding Member of the NAS of Ukraine (Institute of Organic Chemistry, the NAS of Ukraine), *Ye.V. Lebedev*, Full Member of the NAS of Ukraine, and Prof. *Yu.V. Saveliev* (Institute for Chemistry of High Molecular Weight Compounds, the NAS of Ukraine) for understanding and effective support.

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ЗАВДАННЯ, ДОСЯГНЕННЯ ТА ПЕРСПЕКТИВИ
ІНСТИТУТУ ФІЗИКО-ОРГАНІЧНОЇ
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ім. Л.М. ЛИТВИНЕНКА НАН УКРАЇНИ

Наведено короткий історичний екскурс становлення та розвитку Інституту фізико-органічної хімії і вуглекімії ім. Л.М. Литвиненка НАН України. Зроблено огляд основних напрямків наукової діяльності і найбільш вагомих фундаментальних досягнень Інституту, та вирішених на їх основі низки важливих прикладних завдань. Показано внесок Інституту у визначення причин виникнення техногенних аварій і екологічних катастроф, а також в розробку методів їх запобігання та ліквідації. Проаналізовано проблеми і перспективи Інституту в умовах сьогодення.

Ключові слова: ювілей, фізико-органічна хімія, вуглекімія, синтез гетероциклічних сполук.

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ЗАДАЧИ, ДОСТИЖЕНИЯ И ПЕРСПЕКТИВЫ
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Представлен краткий исторический экскурс становления и развития Института физико-органической химии и углекимии им. Л.М. Литвиненко НАН Украины. Сделан обзор основных научных направлений деятельности и наиболее весомых фундаментальных достижений Института и решенных на их основе ряда важных прикладных задач. Показан вклад Института в определение причин возникновения техногенных аварий и экологических катастроф, а также в разработку методов их предотвращения и ликвидации. Проанализированы проблемы и перспективы Института в современных условиях.

Ключевые слова: юбилей, физико-органическая химия, углекимия, синтез гетероциклических соединений.

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