January was the 100th anniversary of the birth of Academician Valentin Alekseevich Kargin, an outstanding Russian physical chemist and founder of polymer science in this country.

Kargin’s name has come to occupy a prominent place in the history of polymer chemistry and physics not only in the USSR but also in the whole world. Many of Kargin’s ideas and the approaches he developed to explain a variety of phenomena in the physical chemistry of polymers have long outlived their author to become paragraphs of textbooks or to have been turned into manufacturing processes that are still used.

What were Kargin’s key achievements in the physics and chemistry of macromolecules and polymeric materials? The structural approach to almost any phenomenon in polymer chemistry and physics constitutes the principal scientific method of this eminent scientist. Special emphasis should be focused on his research activities in the area of structure of polymers, particularly, polymer bodies lacking strict three-dimensional order.

Kargin, together with his pupils, followed ideas relating to ordering within the noncrystalline state and devoted great efforts and time to give a clear picture of what the amorphous or semicrystalline (as they were earlier designated) polymer bodies are. Self-organization of macromolecules in polymers, the genesis of the supramolecular structure in them, and the relationship between these structures and the mechanical properties of polymers are the fundamental contribution of Kargin and his scientific school. There is no doubt that, in the 1950s–1960s, these studies played a very important role and aroused interest in the structural aspects of physical and physical chemistry of macromolecular compounds not only in the USSR but also abroad.

The thermomechanical methods of studying polymer bodies are always associated with Kargin. These methods became routine for the rapid estimation of temperature and phase transitions after pioneering studies by Kargin in the late 1940s. Let us note Kargin’s analysis of the feasibility of plasticization processes in polymers and their implications for polymer processing. In general, modern mechanics of polymer glasses and mechanics of rubbery bodies includes, in particular, the fundamental contribution of Kargin and his school. Furthermore, let us note the model of the mechanical behavior of polymer bodies that came into use as the Kargin–Slonimskii model.

In the mid-1930s, Kargin was one of the first who showed that solutions of polymers, primarily cellulose derivatives, are thermodynamically equilibrium systems and that they should be treated as true solutions rather than colloid systems, as was frequently the case at that time. The implications of this concept were very important not only for fundamental polymer science but also for processing of polymer systems from solutions.

Of great significance is the contribution of Kargin and his school to the theory and practice of polymerization reactions under extreme conditions. The progress in this field is primarily related to the work of his university “youths,” above all Kabanov and his pupils, who later became scientific “grandchildren” of Kargin but the first works were run under his initiative. The same is true of structural-chemical problems encoun-
tered in the modification of polymer materials and of basic relationships that Kargin managed to establish in the field of graft and block copolymers. In the late 1950s and the early 1960s, Kargin demonstrated how chemical reactions in polymer chains facilitate formation of supramolecular structures in polymers and how supramolecular organization in turn affects the kinetics, mechanism, and structure of products arising from polymer-analogous transformations and intramolecular reactions. In general, the structural approach to reactions of polymer formation and transformation constitutes the basic contribution of Kargin and his school to the chemistry of macromolecular compounds.

Finally, let us note the Kargin’s contribution in the area of design and processing of polymeric materials, where Kargin was, in fact, an ideological leader and scientific consultant at the All-Union Institute of Aircraft Materials and at a leading research institute in the field of polymer glasses for aircraft as well as a science consultant in the domestic rubber industry, where extremely important studies on the structure–mechanics relationship were performed for glassy and elastic bodies under dynamic regimes. These studies were also aimed at elucidation of the role of fillers in surface phenomena.

However, it seems that Kargin is best remembered for his role as one of the first researchers both in this country and abroad who formulated and began to actively promulgate the concept of polymer science as an independent branch of science united by common principles and laws controlling the behavior of long polymer chains. It was believed for a long time (sometimes this view may be encountered today) in some communities of chemists that polymer science is solely a part of organic chemistry or materials science and that there is no particular science here. This indisputable contribution of Kargin always—during his life and after his death—was highly appreciated by almost all leading polymer scientists of the world.

It is interesting that Kargin’s role had privately won peculiar recognition already during World War II. In 1942, the Academy of Sciences summed up the achievements of science during the 25 years after the Great October Revolution. Under the decision of the Editorial and Publishing Council of the Academy of Sciences, the collection “Soviet Chemistry over 25 years” was published. As was mentioned in the Introduction, “well-known chemists taking an active part in branches of science they helped shape” were invited as authors. Along with articles written by world-known academicians N.D. Zelinsky, A.N. Frumkin, V.G. Khlopin, V.M. Rodionov, A.E. Arbuzov, and N.N. Semenov, this collection contained the article by Dr. Sci. (Chemistry) V.A. Kargin “Structure and Physical-chemical Properties of Macromolecular Compounds.” In this paper, the community of structure and properties of all synthetic and natural polymers is discussed because chain molecules form their basis. At that time, this viewpoint was far from being universally recognized, the term lyophilic colloids was in use, and discussions were in progress. Today, after 55 years, this paper by Kargin may be recommended to polymer students as an example of the conceptual presentation of a branch of science.

Kargin was held with very great regard by nearly all leading polymer scientists of the world, and his papers, plenary lectures, and lectures at international IUPAC symposia and other scientific meetings or during his visits to universities and companies were always successful.

On Kargin’s initiative, the International IUPAC Symposium on Polymers was held in Moscow in 1960, with Kargin serving as chairman of the organizing committee. This symposium demonstrated the success of the Soviet polymer school, where along with Kargin, many outstanding representatives of chemical science, such as academicians N.N. Semenov and S.S. Medvedev, delivered brilliant lectures. Numerous young scientists took part in the symposium as well. In fact, Kargin had demonstrated to the world community the work of talented scientists in the Soviet Union and that their works fully satisfied international standards.

In the mid-1950s, Kargin became aware of the necessity of polymer education for university chemists. Up to that moment, either chairs dealing with the processing of plastics or chemical fibers or related to polymer chemistry and engineering existed at universities. The activities of all these bodies were directed at solving applied problems.

Kargin was the first to fully distinguish the significance of polymer training for future research chemists. His proposal to establish the Chair of Macromolecular Compounds at Moscow State University in 1935 was dictated not only by his desire to have an additional scientific cell. From the very outset, he began to think over how specialists should be trained and what lectures should be delivered. Officially, the chair was established in 1955, and already in 1956 the first research fellows were engaged in active work. Today, this large world-renowned center is devoted to the physical chemistry of polymers.

The first university chair of macromolecular compounds appeared in Moscow but Kargin kept thinking about organization of similar chairs at other universities. They gradually appeared in the universities of Tashkent, Alma-Aty (Almaty), Leningrad (St. Petersburg), Gorky (Nizhni Novgorod), and Sverdlovsk (Yekaterinburg).

Kargin always had many pupils from various regions of the Soviet Union. He had specially wide relations with Uzbekistan. Kargin took care that the young generation of Uzbek chemists became well-educated. Many representatives of this region studied at the university chair and at the Karpov Institute of Physical Chemistry.