Journal of Macromolecular Science, Part A
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713597274

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To cite this Article (1979) 'Alfred Anisimovich Berlin', Journal of Macromolecular Science, Part A, 13: 8, 1045 — 1049
To link to this Article: DOI: 10.1080/00222337908056698
URL: http://dx.doi.org/10.1080/00222337908056698

J. MACROMOL. SCI.–CHEM., A13(8), pp. 1045-1049 (1979)

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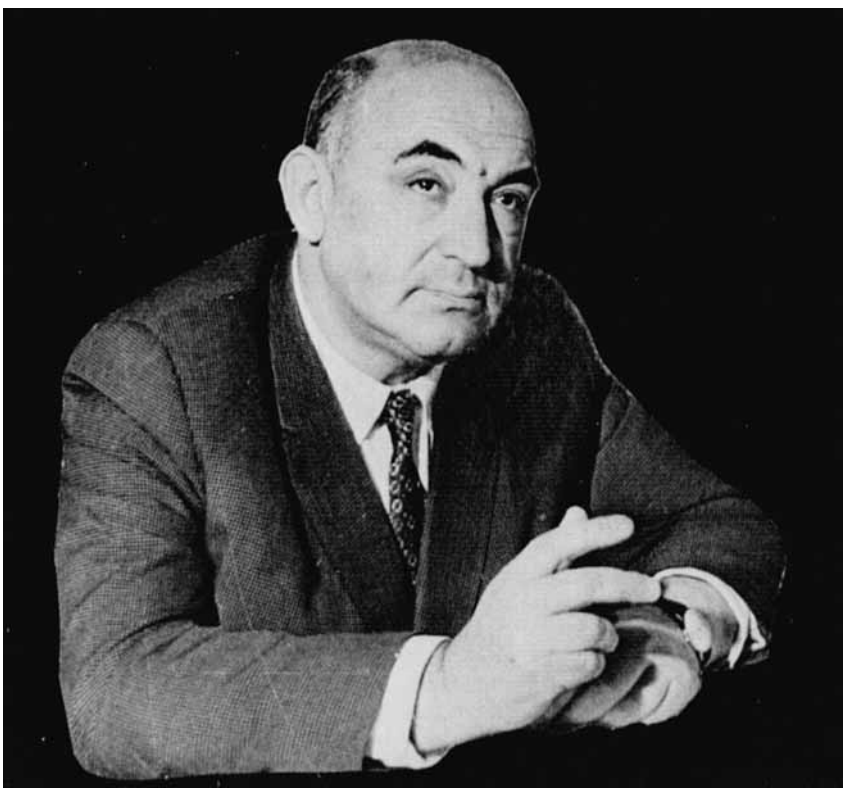
Professor Alfred A. Berlin was born on July 11, 1912 to the family of a musician in Dnepropetrovsk. There he finished school and a chemical college. Then the family moved to Moscow. In 1932 he



entered the Mendeleev Institute of Chemical Technology and in 1937 graduated from it. In 1942 he obtained his first scientific degree in the chemistry of ketones. His adviser was Academician P. P. Shorygin. Later he became interested in the chemistry of high molecular compounds, and in 1952 gained his doctorate for his work in the field of foam plastics.

For the last twenty years of his life, Dr. Berlin was in charge of the laboratory of Synthesis and Modification of Polymers which he had organized at the Institute of Chemical Physics headed by the Nobel Prize Winner, Academician N. N. Semenov.

The scientific activity of Professor Berlin was many-sided. His works are considered to be basic for the development of the chemistry of polymers with conjugated bonds and the chemistry and technology of polymerizable oligomers. They are of fundamental importance for mechanochemistry of polymers, block and graft copolymerization, synthesis of adhesives and foam plastics, for chemical modification of natural and synthetic polymers and served as the basis for the development of many branches of industry of polymeric materials in the USSR.

Professor Berlin considered as his life work the development of scientific and technological principles of a basically new method of synthesis and modification of polymers. The idea of the method is simultaneous formation of articles and network polymerization of liquid or low melting oligomers with terminal functional groups. In this field, Berlin worked out original methods of synthesis of polymerizable oligomers: a method of condensation telomerization and a method of controlled polymerization of cyclics which make it possible to prepare oligomers with terminal, regularly and randomly distributed reactive groups. With the help of these methods, a great number of representatives of new classes of polymerizable oligomers were obtained, including oligoester acrylates and dehydrochlorinated and acrylated chloroparaffins, which differ in the size and structure of the oligomer block. This led to preparation on the basis of oligomeric substances of polymeric materials with various physicomechanical properties.

Great attention was given by A. A. Berlin to kinetic studies of three-dimensional polymerization and to investigation of the relationship between the structure and reactivity of oligomers and the properties of network polymers on their basis. As a result, it was shown that the kinetics of transformation of oligomers into high polymers are governed by the chemical structure, viscosity, and physical structure of oligomeric liquid, by its ability to form associates which, in turn, determine the degree of ordering of network polymers and the possibility of formation of supermolecular structures. It was also shown that at a fixed length of the molecules of oligo(alkylene glycol)diacrylates, the network polymers derived from them crystallize to form crystals identical with the structure of the starting

oligomers. On the other hand, the network polymers prepared by solution polymerization crystallize to form crystals with symmetry different from that of the crystals of the starting oligomer. The fact that the crystalline structures of the oligomers and network polymers prepared by bulk polymerization at temperatures above the phase-transition temperature are identical suggests fixation of the order in liquid during formation of the network polymer.

The basic regularities relating the chemical and physicomechanical properties of network polymers to the structure and length of oligomeric block and to the polymerization conditions were determined for a series of different types of oligoester acrylates.

A. A. Berlin gave much thought to the studies leading to development of the basic principles of chemistry of polymers with a conjugation system. These studies were started in 1955, many years before the beginning of systematic studies in other laboratories, and led to a new field of polymer chemistry–the chemistry of polymers with a conjugation system (PCS).

In this field, A. A. Berlin advanced some basic theories and developed new methods of synthesis of such polymers. This allowed him to prepare a great number of new polymeric substances with acyclic, aromatic, and heterocyclic conjugation systems. These polymers of linear, ladder, or three-dimensional network structures exhibit high thermal stability, semiconducting, catalytic, redox, and other valuable properties.

It was found, as a result of the studies of chemical transformations of PCS, that they are able to initiate polymerization and copolymerization of electron-accepting monomers (acrylates, acrylonitrile) and to become a part of block copolymers. This process occurring via formation of the donor (PCS)-acceptor (monomer) complex was named "quasiradical polymerization."

The reactivity of PCS was studied in great detail. It was shown that they are characterized by abnormally high energies of intermolecular interactions, by the phenomenon of thermoexcited paramagnetism, and by the dependence of reactivity on the size of conjugation blocks. In 1962 A. A. Berlin discovered the local activation effect–the influence of paramagnetic centers of ion-radical nature on the chemical properties of PCS–and proposed a phenomenological theory explaining the influence of paramagnetic centers on the properties of the systems in question by the free spin-exchange interaction with the π-electrons of the molecules in this complex.

Of particular scientific and practical importance are the original studies on the use of PCS as inhibitors of high-temperature (300-400°C) thermal-oxidative, photo- and radiation-induced degradation of some commercial polymers (polysiloxanes, polycarbonates, polyarylates, aromatic polyamides, PVC, polyesters, etc.). It was found that microadditions of PCS to amorphous polymers (phenolic plastics, polyarylates, polyesters) change the supermolecular

structure, which leads to increase of the mechanical strength of polymers. Wide-range conductivity semiconductors were prepared on the basis of low and high molecular compounds with a conjugation system. Some methods were developed allowing a sharp increase of the photoconductivity of PCS, which opens possibilities for their use in electrography and electronics as well as some methods for preparation of thin polymeric films with high mobility charge carriers.

A. A. Berlin devised original methods of synthesis (e. g., onium and quasiradical polymerization, polydeamination, polycoordination of nitriles) and prepared a large number of new polymers with high thermal stability and processibility (polyarylenes, ladder PCS, polyporphirazines, polyphenanthrolines, etc.) and also PCS with a high electron-exchange capacity and a wide range of redox potentials.

A. A. Berlin was one of the first scientists working out the principles of graft copolymerization. As early as 1946-1948 he obtained branched and network graft copolymers with a wide variety of properties. These studies led to the commercial production of impact-resistant polystyrene and PVC.

In the same period, A. A. Berlin proposed a basis for wide modification of the properties of polymers by combination of high molecular polymers with oligomers, i. e., the preparation of polymer-oligomer compounds in which oligomer acts as a temporary or reactive plasticizer. Cured compounds are systems in which a linear polymer is chemically bound with a network polymer formed as the result of curing of oligomer. This led to preparation of curable PVC, film binders, modified rubbers.

It was shown in studies on the interaction of oligoester acrylates with rubbers and on the structure of the vulcanizates formed that oligomer not only crosslinks the chains of rubber molecules but also forms inclusions of network aggregates resulting from three-dimensional homopolymerization. These highly dispersed inclusions chemically bound with rubber act as a specific filler responsible for the high strength, enhanced flexing resistance, and lower hysteresis losses of polymer-oligomer rubber compounds as compared with carbon black-loaded rubber vulcanizates. For the first time, high-strength vulcanizates were obtained by direct transition from monomer and oligomer to a finished article by simultaneous production of diene polymer and network polyester acrylate to form cross-linked systems in which polyester acrylates are highly dispersed chemically bound fillers.

A. A. Berlin is one of the founders of the mechanochemistry of polymers. He established the main laws governing the mechanochemical reactions, in particular block copolymerization under mechanical stress and under the action of ultrasound.

In 1954 in studies on starch and proteins solutions A. A. Berlin found that the phase transition of water brings about degradation of

polymer macrochains in solution to form macroradicals and macroions capable of further transformations in particular of forming block copolymers (cryolysis and criochemistry of high polymers).

Along with research in the chemistry of synthetic high polymers, A. A. Berlin carried out a series of studies on the chemical structure of natural wood polymers, the methods of its modification, and production of high-strength materials on the basis of modified wood possessing thermoplasticity.

Of great significance are Professor Berlin's efforts in the development of the scientific foundations of production and reprocessing of foamed and cellular plastics. These studies lead to the development in the USSR of gas-expanded materials, and the types of foamed plastics evolved by A. A. Berlin and co-workers have found use in industry. In 1949 for his work on the development of foamed plastics A. A. Berlin was awarded the State Prize in Chemistry.

A. A. Berlin also made his contribution to some other branches of chemistry and technology of polymers. He was one of the first to prepare new types of thermally stable hermetics and compounds, film materials for food industry, highly effective initiators of polymerization of vinyl chloride and some other vinyl monomers. Of great importance are the new crosslinked olefin polymers, PV, and synthetic rubbers devised by A. A. Berlin and co-workers and also the oligomer plasticizers and stabilizers of chlorinated polymers developed by them.

In spite of his being extremely busy with his research, A. A. Berlin gave much attention to training a new generation of scientists. For many years he was Professor of Chemistry at the Lomonosov Institute of Fine Chemical Technology. Later many of his former students worked under his guidance while with others he remained in touch for many years after graduation. This led to establishment of a school with Professor Berlin at the head which was engaged in studies in the chemistry of oligomers–a new direction of the chemistry of polymers.

Professor Berlin's long and fruitful activity (he published more than 650 scientific papers and 8 monographs) gained well-deserved recognition among the scientists all over the world. He was elected to the New York Academy of Sciences as a titular member and to the Gesellschaft Deutscher Chemiker as an honorary member.

He was a man of immense erudition and great personal charm. He was always ready to share his experience and original ideas with his colleagues, pupils and followers.

Professor Berlin as scientist and man will be always remembered by those who knew him.

Accepted by editor December 29, 1978
Received for publication February 20, 1979