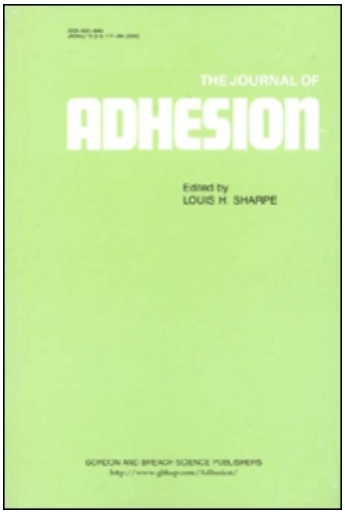

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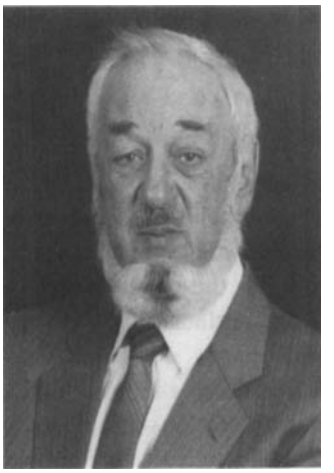
Yuri S. Lipatov – A Tribute on his 70th Birthday

Yuri S. Lipatov, a prominent scientist in the broad field of physical chemistry of polymers, will celebrate his seventieth birthday on 10 July, 1997. This issue of **THE JOURNAL OF ADHESION** celebrates this occasion with the Lipatov Collection, a group of papers contributed by some of his friends, colleagues and former students.

Professor Lipatov's professional career can be roughly subdivided into three major periods. The earliest one spans the time interval from 1949, the year when he graduated from Gubkin Oil Institute (Moscow, Russia), to 1964 when he moved to the Institute of Macromolecular Chemistry, (IMC), National Academy of Sciences of Ukraine (NASU) (Kiev, Ukraine). During that period he earned his Ph.D. at the Karpov Institute of Physical Chemistry in Moscow with Professor V. A. Kargin as his advisor. He started systematic studies of filled polymers, his life-long favorites, at the Institute of General and Inorganic Chemistry, Academy of Sciences of Belorussia (Minsk, Belorussia). At the age of 36, he completed his next (D.Sc.) thesis and shortly thereafter became a Professor.



Yuri S. Lipatov

The scope of research interests of Professor Lipatov considerably broadened during the next period of about 20 years when he was the Director of the IMC, NASU (Kiev, Ukraine). The results of the active research into structure-

property relationships in polyurethanes were summarized in the monograph:

Yu. S. Lipatov, L. M. Sergeeva and Yu. Yu. Kercha, *Physical Chemistry of Polyurethanes* (Naukova Dumka, Kiev, 1971).

Comprehensive studies of adsorption of individual polymers and of polymer blends from dilute and semi-dilute solutions onto solid particles led to formulation of the concept of the polymolecular (aggregate-like) mechanism of adsorption. These data were extensively discussed in the monograph:

Yu. S. Lipatov and L. M. Sergeeva, *Adsorption of Polymers* (Naukova Dumka, Kiev, 1972).

Moreover, broad experience in adsorption phenomena proved indispensable in obtaining a deeper insight into the problem of structure formation and properties of filled bulk polymers. The result was the now-famous three-phase model of filled polymers, explicitly accounting for the existence of boundary layers, structurally different from the pure polymer, at the polymer-filler interface. This model was first introduced in the monograph:

Yu. S. Lipatov, *Physico-Chemistry of Filled Polymers* (Naukova Dumka, Kiev, 1968).

More detailed and elaborated versions of this model can be found in:

Yu. S. Lipatov, *Physical Chemistry of Filled Polymers* (Khimia, Moscow, 1977) and Yu. S. Lipatov, *Interfacial Phenomena in Polymers* (Naukova Dumka, Kiev, 1980).

Recognition of boundary layers as weak sites in filled polymers proved extremely helpful in understanding, predicting and improving their mechanical performance.

Starting in the mid-seventies, Professor Lipatov's attention was attracted to interfacial interactions in polymer-polymer systems, such as blends of linear polymers and interpenetrating polymer networks (IPNs). Extensive thermodynamic and structural studies of these systems permitted the singling-out of incomplete microphase separation as the main source of their thermodynamic instability. Basic aspects of this problem were extensively discussed in the following monographs:

Yu. S. Lipatov and L. M. Sergeeva, *Interpenetrating Polymer Networks* (Naukova Dumka, Kiev, 1979); Yu. S. Lipatov, V. V. Shilov, Yu. P. Gomza and N. E. Kruglyak, *X-Ray Methods of Characterization of Polymer Systems* (Naukova Dumka, Kiev, 1982) and A. E. Nesterov and Yu. S. Lipatov, *Thermodynamics of Polymer Solutions and Blends* (Naukova Dumka, Kiev, 1984).

Aspects of the practical application of this knowledge to develop novel hybrid adhesives and composite materials can be found in:

Yu. S. Lipatov, *Colloid Chemistry of Polymers* (Naukova Dumka, Kiev, 1984).

The third period started in 1985, the first year of *perestroika* in the former Soviet Union. Under the false insinuation by the Central Committee of the ruling Communist Party of Ukraine, supported by the Presidium of the Academy of Sciences of Ukraine, according to which the IMC under his directorship was not solving basic scientific problems, Professor Lipatov was displaced from his position as the Director of the IMC. This dramatic change of his official standing, however, proved extremely beneficial to him as regards further development of his research areas. During the following years, the concept of hybrid adhesives was elaborated still further. As specified by Professor Lipatov, these comprise polymer alloys (PAs) and IPNs. The concept of PAs is based on the analysis of phase diagrams of binary blends of linear and cross-linked polymers exhibiting Upper and Lower Critical Solution Temperatures. In this context, hybrid binders may be defined as two- or multi-phase systems, in which sizes, pattern of distribution and properties of particles of one phase are controlled by the phase diagrams of the initial system, by kinetic regimes of crossing the binodal and the spinodal, and by the mechanism of phase separation (nucleation or spinodal decomposition). In such systems, incomplete phase separation, resulting in formation of interfacial layers, plays a decisive role.

A special case of PAs is IPNs where phase separation was shown to be intimately related to formation kinetics of the component networks, to the ratio of the components and to the reaction sequence. The eventual chemical and physical structures of IPNs (that is, the degree of chemical conversion, the composition of separated micro-

phases and the degree of microphase separation) proved to be formed in thermodynamically non-equilibrium conditions due to concurrent chemical (cross-linking) and physical (phase separation) processes. Thus, structure formation in PAs and IPNs can be looked at as a sort of a non-equilibrium, self-organization process.

The other major research effort of Professor Lipatov addressed reaction kinetics and phase separation in PAs reinforced with disperse and fiber-like fillers. Experimental studies of adsorption of mixtures of compatible and incompatible polymers from solution onto solid substrates provided evidence for selectivity of adsorption and its impact on the structure of adsorption layers. Selectivity of adsorption was shown to change the thermodynamics of interaction of the components with the solid; the result was the dependence of composition and properties of boundary layers on the distance from the interface. These data formed the empirical basis for a new concept of non-equilibrium compatibilization of components at the interface, and of its influence on the kinetics of chemical reactions and of phase separation. This concept proved helpful to a better understanding of the thermodynamics of adhesion of PAs to solids, allowing for a non-equilibrium segregation of components in the boundary layers.

Professor Lipatov's research activity during the third period is documented not only in numerous articles (it is pertinent to remark here that the total number of his scientific publications reached the respectable figure of around 1200 and nearly one-third of them were published after 1985) but also in several monographs, including the following:

Yu. S. Lipatov, *Colloid Chemistry of Polymers* (Elsevier, Amsterdam and New York, 1988); Yu. S. Lipatov, *Physico-Chemical Principles of Polymer Reinforcement* (Khimia, Moscow, 1991); Yu. S. Lipatov, *Polymer Reinforcement* (ChemTech Publ., Toronto, 1994); A. E. Nesterov and Yu. S. Lipatov, *Thermodynamics of Polymer Blends* (ChemTech Publ., Toronto, 1997); Yu. S. Lipatov, *Phase-Separated Interpenetrating Polymer Networks* (Gordon & Breach, accepted for publication).

Seminal contributions of Professor Lipatov to the science of multicomponent polymer materials have been well-recognized and appreciated by the international scientific community. He serves as a member of the Editorial Boards of several Journals, including *Dopov. Akad.*

Nauk (Ukraine); *Vysokomol. Soed.* (Russia); **THE JOURNAL OF ADHESION** (USA) – of which he is an Associate Editor; *Composite Interfaces* (USA) and *J. Polymer Materials* (India).

He has won many awards. To cite the last few – the title of a Distinguished Person in Science and Technology of Ukraine (1990); Membership in the Russian Academy of Creative Endeavour (1992) and its P. J. Flory prize (1997).

Numerous friends worldwide, his collaborators and the former students of Professor Lipatov (in fact, he was the supervisor of more than 60 Ph.D. theses and of over 10 D.Sc. theses) wish him good health and fruitful activity in the years to come!

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