Obituary

Boris Vladimirovich Derjaguin 1902–1994

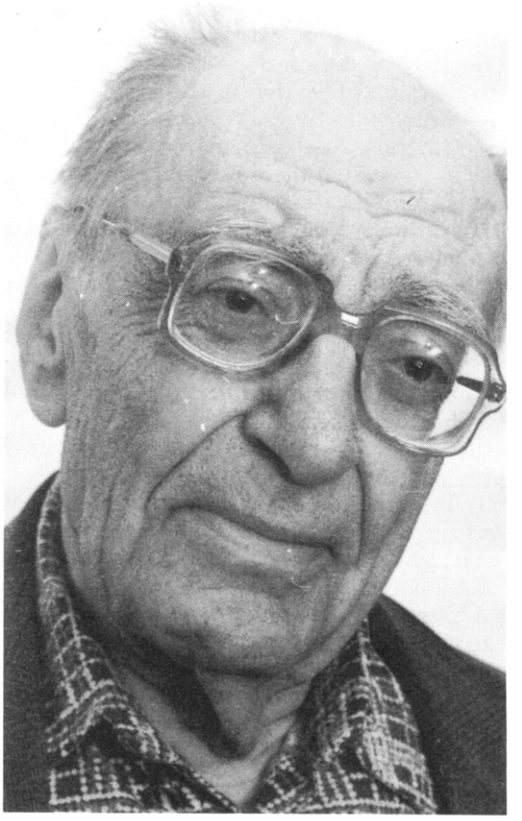
Professor Boris Vladimirovich Derjaguin died on May 16, 1994, at age 92. A member of the Russian Academy of Sciences, a great physicochemist, and a world-renowned scientist, he laid the foundation of the modern science of colloids and surfaces. An epoch in the development of the physical chemistry of colloids and surfaces is associated with his name.

Educated in the families of the well-known Russian physicists P. N. Lebedev and P. R. Lazarev, Boris Vladimirovich Derjaguin became their successor in the glorious tradition of Russian science. After graduating from the physicomathematical faculty of the Moscow State University, he began his scientific career at the Biophysical Institute working under the supervision of Academician Lazarev on problems in acoustics and the physics of eyesight. In 1932, his laboratory was transferred from the Biophysics Institute to the Institute of Applied Mineralogy, where he studied thin layers of liquids in disperse mineral systems for the first time. Starting in 1935, his research was transferred to the Colloidal Electrochemical Institute of the USSR Academy of Sciences, later renamed the Institute of Physical Chemistry, where Boris Vladimirovich continued his scientific activity until the last days of his life.

B. V. Derjaguin became known world-wide in scientific circles for his work on the stability of colloids and thin films of liquids which is now known as the DLVO theory, after the initials of its authors: Derjaguin, Landau, Verwey, and Overbeek. It is universally included in text books on colloid chemistry and is still widely applied in modern studies of interparticle forces in colloids. In 1990, he was awarded a USSR State Prize for his development of the theory of the stability of colloids and thin films.

Boris Vladimirovich represented a rare example of the harmonious combination of a theoretician with an experimentalist. His contributions to the development of the theory of surface forces and the theories of nucleation, of the stability of colloids and thin films, of the condensation of vapors, of frost heaving of soils, and of diffusiophoresis, capillary osmosis, and thermophoresis are widely appreciated. Being a brilliant experimentalist, he was the first to make direct measurements of long-range molecular forces, for which he was awarded the Lomonosov Prize of the USSR Academy of Sciences.

B. V. Derjaguin's ideas concerning the disjoining pressure of thin layers and its various components enabled one to pass from two-dimensional Gibbs thermodynamics to the three-dimensional thermodynamics of multiphase systems, taking into account finite layer thickness, the unique properties of interfacial layers, and the long-range action of surface forces. He introduced the notion of the structural component of the disjoining pressure which results from the overlapping of liquid boundary layers that have different structures from the bulk. He was also the first to put forward the hypothesis of the formation of boundary phases separated by sharp discontinuities from the adjacent bulk phases which was later substantiated experimentally. The existence of boundary phases possessing structures analogous to those of liquid crystals has been detected for a large number of liquids. He



suggested theoretically and applied a blow-off method to measure the boundary viscosity of liquids.

In his work on the adhesion of solids, B. V. Derjaguin discovered that the fresh surfaces created by solid fracture are coated by dense charged layers with opposite signs. This led to the appearance of an electronic component of adhesion. A theory of the formation of a double layer at the contact of solids was developed and the important role of donor–acceptor interactions was demonstrated. In connection with this research, the theory of the sticking of particles upon collision with a solid substrate, taking contact polarization into account, becomes of great practical significance. The emission of fast electrons and X-rays upon breaking of an adhesive contact in vacuum was discovered. B. V. Derjaguin also detected emission of neutrons on fracturing deuterium-containing solids as a consequence of nuclear processes taking place at room temperature.

The theory of the interaction of curved surfaces occupies a special place in colloid and surface science. Starting in 1934, this theory was widely applied as a way for passing from the interaction of flat surfaces to the interaction of particles of arbitrary shape. This led to the possibility of the utilization of macroscopic bodies of arbitrary shape for the determination of surface forces. In developing this area of research, B. V. Derjaguin developed a sensitive method for the measurement of surface forces between thin crossed threads which enabled one for the first time

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to directly measure the molecular forces of attraction of opaque solids (i.e., metals) as a function of separation distance.

In recent years, Derjaguin suggested a new approach to the thermodynamics of thin layers, providing a new possibility for the experimental determination of the layer thickness. Unfortunately, he did not live to see the realization of that method.

A long series of studies in the physics of aerosol particles was carried out under B. V. Derjaguin's direction. A theory of the motion of aerosol particles in a temperature and concentration gradient was developed and experimentally substantiated by application to the problem of particle capture. A theory of the inertialess capture of aerosol particles from their streamline flow past an obstacle was developed and its experimental verification was effected. A method for inhibiting the formation of warm fogs by the adsorption of high molecular weight alcohols on atmospheric nuclei was verified under laboratory and field conditions.

As early as 1950, studies of the synthesis of diamond under low pressure were begun under the supervision of B. V. Derjaguin. Experimentally and theoretically, it was shown that the important influence of atomic hydrogen on the gasification of nondiamond forms of carbon allowed the synthesis of diamond from the gas phase on various substrates. Both monocrystalline and polycrystalline diamond films were obtained.

The research efforts of B. V. Derjaguin have been characterized by thoroughness of the theoretical developments based on physical concepts and by the originality of their approach to the analysis of complex phenomena. This was combined with elegance of the experimental techniques and choices of the simplest and most convincing ways of elucidating the mechanisms and nature of the phenomena under study. He left a large scientific inheritance. He published more than 1000 papers and monographs, in Russian and abroad. Recently, Pergamon Press has published selected works of B. V. Derjaguin in three volumes in the series *Progress in Surface Science*. Many generations of scientists will benefit from this work.

The activities of Professor Derjaguin in the area of scientific organization have been extensive. Since 1959, he has organized and supervised many conferences on surface forces. These conferences were attended by leading scientists from all over the world and enjoyed high popularity and great international recognition. The tenth and last of these conferences was held in Moscow in August 1992 on the occasion of his 90th anniversary.

In 1965, B. V. Derjaguin was awarded an Honorary Doctorate by Clarkson College. He was a member of the Faraday Society and for several years he served as the vice president of the International Association of Colloid and Surface Scientists. Besides the Russian Academy of Science, he was a member of the International Academy of Science "Leopoldina", the New York Academy of Science, and the Russian Academy of Natural Science.

Over the years, Boris Vladimirovich attracted numerous scientists as pupils and co-workers. In the field of surface research, there are many who have excellent memories of this man, both among those who only acknowledged his talents and those who actually worked with him. Further development of his ideas and expansion of their practical application will constitute the best memorial to this outstanding scientist.

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