[7]M. G. Nikulin, ibid No. 2, 21 (1970).
[8]M. G. Nikulin, Nuclear Fusion (in press).

On 26 March 1970 there was held in the conference hall of the Physics Institute of the USSR Academy of Sciences a scientific session of the Division of General Physics and Astronomy of the USSR Academy of Sciences, jointly with the Scientific Council on Solid-state Physics of the USSR Academy of Sciences. The following papers were delivered:

1. S. V. Vonsovskiĭ, Lenin's Theory of Learning and Modern Physics.
2. A. F. Andreev and I. M. Lifshitz, Quantum Theory of Defects in Crystals.
3. P. A. Rebinder and E. D. Shchukin, Physical-Chemical Phenomena in Processes of Deformation, Failure, and Working of Solids.
4. B. K. Vaĭnshteĭn, V. I. Simonov, and D. M. Kheĭker, The Project "Aroks" (Automatic X-ray Determination of Crystal Structures).
5. Kh. S. Bagdasarov and V. Ya. Khaimov-Mal'kov, New Methods and Results of Synthesis of High-Melting-Point Single Crystals.
6. E. A. Turov, Certain Problems in the Contemporary Theory of Magnetism.
7. S. A. Al'tshuler, Electron-Nuclear Magnetic Resonance.

We publish below brief contents of the delivered papers.

S. V. Vonsovskii, Lenin's Theory of Learning and Modern Physics.

The content of the paper was published in the April (Jubilee) No. 4 of v. 29 of the Journal "Physics of Metals and Metallography" in 1970.

A. F. Andreev and I. M. Lifshitz. Quantum Theory of Defects in Crystals

At sufficiently low temperatures, localized defects or vacancies are transformed into excitations that move practically freely through the crystal. As a result, instead of ordinary diffusion of the defects, there arises a flow of a "fluid" consisting of "defectons" and vacancions." It is shown that at absolute zero, in crystals with large amplitude of zero-point oscillations (for example, such as solid helium), there can exist zero-point defectons, as a result of which the number of sites of the ideal crystal lattice may not coincide with the number of atoms. The thermodynamic and acoustic properties of crystals with zero-point defectons are discussed. Such a crystal is neither a solid nor a liquid. Two types of motion are possible in it—one has the properties of motion in an elastic solid and the other in a liquid. Under certain conditions the "liquid" type of motion of the crystal has the property of superfluidity. Analogous effects should be observed also in quasi-equilibrium states with a given number of defectons.

[1]A. F. Andreev and I. M. Lifshitz, Zh. Eksp. Teor. Fiz. 56, 2057 (1969) [Sov. Phys.-JETP 29, 1107 (1969)].

P. A. Rebinder and E. D. Shchukin, Physico-chemical Phenomena in Processes of Deformation, Failure and Working of Solids

The paper reports results of a study of the main laws and physical nature of the influence of surface-active media on the strength and deformability of solids.

Effects whereby the processes of deformation and failure and facilitated as a result of a reversible physico-chemical influence of the medium, to the extent that the strength of the body decreases by many times and the body becomes very brittle, have been established by now for all types of solids—crystalline and amorphous, continuous and porous, with metallic, covalent, or ionic molecular structures. The common nature of these phenomena is that the breaking and re-alignment of the interatomic bonds becomes facilitated in the presence of definite foreign atoms or molecules (having a sufficient mobility to ensure their penetration into the bond-breaking zone), and can be described as a decrease of the work of formation of new surfaces during the course of the deformation and rupture, i.e., as a lowering of the free surface energy of the solid under the influence of the surrounding medium.

A comparison of the theoretical estimates and of the direct experimental determination of the magnitude of lowering of the surface energy of solids and of the observed effects of decreased strength under the influence of the medium reveals a rigorous correlation in all cases when these effects become manifest: for solid metals (and also for some covalent crystals), in contact with liquid metals, for ionic crystals in the presence of molten salts, water, alcohols, and other polar media, and for molecular crystals or organic compounds in contact with non-polar and low-polarity organic liquids.

The main condition under which a medium has a strong influence on the mechanical properties of a body (in the considered cases of reversible adsorption interaction not connected with solution, corrosion, and other chemical processes) is that the solid be genetically related to the medium; this relation causes the low values of the surface energy on the boundary between the solid and liquid phases. At the same time, the form and degree of the manifestation of these effects depend in a complicated manner on the real structure of the body (defects) and on the deformation conditions—stresses, temperature, rate of deformation, contact time, etc. The optimal combination of these factors makes it possible to use the influence of the medium to facilitate the processes of dispersion and working, especially of hard and difficult-to-work materials. To the contrary, the elimination of the individual factors needed for the manifestation of absorptive lowering of the strength uncovers ways of protection against the influence of the medium.

The main data included in the paper were published by the authors and co-workers in 1967—1970 in a number of communications in Doklady AN SSSR. See also the review by N. V. Pertsov and E. D. Shchukin in the Journal Fizika i khimiya obrabotki materialov (Physics and Chemistry of Material Working) No. 2 (1970).