state of not only the current carriers but also the electrons localized near impurity centers. In particular, the existence of two self-consistent states (stable and metastable), having s-symmetry—hydrogenlike and fluctuon-type states—turns out to be possible at Coulomb centers of large radius. A transition of the electrons from one state to another should occur in the vicinity of a definite temperature [8]. Excitons may also have self-consistent fluctuon states of a different type[9]. Let us note that under definite conditions fluctuon complexes, containing two ("bifluctuons") or several electrons, will appear.

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F. F. Voronov. The Effect of Pressure on the Elastic Moduli of Solids

The paper is a review of the results of experimental investigations of the elastic properties of solids at high pressures. Basically, it describes the ultrasonic method of investigations and three sets of equipment, constructed at the Institute of High-pressure Physics of the USSR Academy of Sciences for investigations at hydrostatic pressures of up to 10 kbar, and at quasi-hydrostatic pressures of up to 30 and 100 kbar. Further, the results obtained are analyzed. It is shown that in a pressure range far from phase transitions, the elastic moduli increase with pressure and the effect of pressure ($\partial \ln M/\partial p$) is proportional to the compressibility of the investigated materials.

An equation of state of solids in the form of the Bridgman polynomial and valid up to 100 kbar, and the Murnagan equations of state are derived from the experimentally determined variation of the bulk modulus.

Analysis of the results of the investigation of the elastic characteristics of ionic crystals on the basis of the Born-Mayer central-force model showed that this model reproduces well the dependence of density on pressure even in the case of large deviations from the Cauchy relation (1 : 6, AgCl), satisfactorily describes the behavior of the bulk modulus under pressure (RbCl, RbI), and gives considerable deviations in the magnitudes of the shear constants and their derivatives with respect to pressure (RbCl).

The question of the anharmonicity of the lattice vibrations is considered—the Grüneisen constants are determined for long-wavelength sound vibrations in the investigated materials.

Distinctive features of the change in the elastic properties when a phase transition of the type NaCl → CsCl occurs in the rubidium halides, or when a 4f → 5d electron transition occurs in cerium, are demonstrated.

Results of investigations of the velocity of sound in polycrystals of NaCl, CsCl and AgCl at pressures of up to 100 kbar are given, and the prospects for the use of the ultrasonic method of investigations of the elastic properties of solids in the condensed state in a wide range of pressures, especially for the study of the properties of high-pressure phases, are noted.

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S. A. Al'tshuler. Spin-phonon Interactions and Mandel'shtam-Brillouin Scattering of Light in Paramagnets

The observation of the Mandel'shtam-Brillouin scattering of light in paramagnetic crystals may give valuable information about the interaction of the spin system with the lattice vibrations. A theoretical analysis has shown that if a magnetic field which gives rise to spin-level splitting is applied and the splitting coincides with the frequency of the phonons participating in the light scattering being observed, then an appreciable shift in the Mandel'shtam-Brillouin component appears.

Especially interesting results may be obtained by combining the paramagnetic resonance and the Mandel'shtam-Brillouin effect. In particular, if a "narrow phonon bottleneck" is produced, i.e., if the rate of energy transfer from the spin system to the resonant phonons is higher than from these phonons to phonons of other frequencies, then at the saturation point of the paramagnetic resonance the effective temperature of the resonant phonons should increase by many factors and, correspondingly, the intensity of the scattered light should increase.

Tests were run on a cerium-magnesium nitrate single crystal, which has suitable paramagnetic and optical properties. Under the conditions of continuous saturation of the paramagnetic resonance, the effective temperature of the resonant phonons increased from 1.5°K to 250°K. If, however, intermittent saturation with frequency somewhat different from the frequency of the paramagnetic resonance was employed, then the effective temperature of the resonant phonons increased to 8000°K in the beginning over a short interval of time of the order of 0.1 μsec. The avalanche-like growth of the number of the resonant phonons is explained by the fact that the experiment was set up under conditions which ensured the population inversion of the spin levels, by virtue of which a phonon masser effect appeared.

In conclusion, the possibility of using the Mandel'shtam-Brillouin scattering to study the various mechanisms underlying spin-lattice relaxation, to observe single-phonon processes at high temperatures, and to detect acoustic paramagnetic resonance is discussed.

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G. I. Distler. The Electrical Structure of Crystals

The electrical structure of crystals, which determines their many physical and chemical properties, is a set of different electrically active defects. The methods of decoration, based on selective crystallization of different substances on the elements of the electrical relief of the surfaces of solids, allows us to visualize at different levels of resolution this relief and its changes.

It is established that the active sites of a real crystal are, apart from isolated point defects, complex active centers—groups of point defects—which act in a number of processes as a unit, as well as micro- and macro-clusters of point defects. Between charged point defects of opposite charge in crystals, there appear polarized line bridges, since it is precisely at these places that the intensity of the electric field has its maximum value. Polarized line structures are often observed at complex active centers, in clusters of radiation defects and in electric double layers at the boundary between two solid phases, the lines being, as a rule, oriented along definite crystallographic directions. Thus, there appears in crystals a lattice structure whose lattice points are electrically active point defects and clusters of them, while the linear sections are micro- and macro-polarized structures.

During crystallization, the formation of nuclei occurs selectively on electrically active point defects, while the growth and coalescence of the nuclei and fairly large particles occur at different rates at localized regions of the surface, the electrical properties of which are determined in the first place by the micro- and macroclusters of point defects. At the negatively charged sections of the surface, physically adsorbed thin layers of water are formed which play the role of a "lubricant." Polarized line structures are also active places during crystallization. Crystallization is, consequently, a matrix replication process, programmed in the electrical structure of the surface of the crystal-substrates (and seedings). A far-reaching analogy between such heterogeneous processes as crystallization and biological processes suggests itself.

The establishment of the fact that the activity of surfaces, in particular, of cleavage and growth steps, manifests itself through their electrical characteristics, calls for a new approach to the dislocation theory of crystal growth. Indeed, the exit points of screw dislocations, which are responsible for the existence of undergrown steps, should be active during the growth

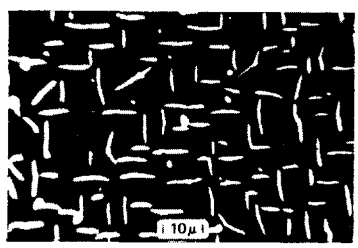

FIG. 1. Picture of oriented crystallization of anthraquinone on the outer surface of a plycrystalline layer of ZnO of thickness 150Å, deposited on the surface of a NaCl crystal.