NEWS and VIEWS

SOLID STATE SYMPOSIUM

EWALD TO HEAD PHYSICS AT BROOKLYN POLY.

As a means of welcoming Paul P. Ewald, formerly of Queens University in Belfast, to the chair of physics of the Brooklyn Polytechnic Institute, an all day conference was held last October 15 on the physics of the solid state. The conference, which was sponsored jointly by the Institute and the Metropolitan section of the American Physical Society, was opened with a paper by Professor Ewald, in which he reviewed the program and placed the various scheduled topics in the general context of crystal physics.

He then got the discussion itself under way by examining the matter of whether an integrating and simultaneous treatment of the properties of the solid state by wave mechanics is to be preferred to a splitting of the theory into separate treatments of the different properties. The latter seems to be simpler in many cases as far as practical interest is concerned. He also mentioned the possibility of a generalization and amplification of the space-group theory of Schoenflies by applying the symmetry operations to vectors and tensors.

Slater in his lecture faced the audience with the most interesting problems still unsolved in the field of solid state (these being superconductivity and the superfluidity of helium which presumably is closely connected to the former). Such problems as the exact computation of lattice energies and elastic constants also require further mathematical treatment, although considerable progress, as Slater pointed out, has been accomplished during the last years. Besides these problems which deal with the "ideal" crystal, many other unsolved problems exist for the solution of which the "real" crystal with its imperfections must be considered.

This real crystal may differ from the ideal by irregularities, deformations, and distortions of the lattice, by migration of atoms, molecules, or excited electrons, and by the transfer of excitation energy along surfaces or through the crystal lattice. Such matters belonged to the main topics of the symposium.

According to Rideal a migration of molecules along a surface of a crystal can easily be demonstrated and measured when a crystal of benzophenone is brought into contact with a metal surface. As long as this contact perseveres, in addition to the loss of weight of the crystal by ordinary volatilization, an escape of molecules along the metal surface takes place. This loss of material can further be increased by running a flow of mercury over a part of the metal surface, because the moving mercury surface carries molecules with it.

The migration of electrons, excited within the crystal, or the transfer of excitation energy, plays an important role in light emission as described by Kallmann. The freed electrons or the excitation energy travel through the crystal and collide on their paths with impurities, irregularities, or distortions. Such collisions may cause a transformation of the excitation energy into heat. Thus a competition exists between this transformation and the reaction of light emission which determines the amount of light actually emitted. Without such a migration of electrons and excitation energy, no quenching would occur and sometimes even no light emission would take place, since, when the light is not emitted by the bulk material but by impurities only, the excitation of these impurities is also attributable to the migration process.

Smekal made it clear in his lecture that imperfections of atomic arrangement determine even the total mechanical behavior of "real" solids. The "ideal" solid with a perfect lattice would considerably deviate from the properties actually observed with crystals in nature. It requires much skill and work to realize the ideal crystal in the laboratory and the slightest deviations of these ideal conditions would produce a thorough change in the behavior of the crystal. In particular Smekal described investigations on hardness by means of a micro-scratcher and showed how the results are related to the type of chemical binding.

A first approach to the mathematical treatment of distortions was given by Shockley. He discussed the behavior of solids under plastic deformations and gave a detailed description of crystal gliding and distortion from an atomic and energetic point of view. His arguments resulted in the formulation of a condition which allows such a point of distortion or imperfectness to be described or characterized mathematically.

The lecture of Burgers chiefly dealt with the phenomenon of recrystallization. In a conglomerate of crystals a single crystal can grow at the expense of the neighboring ones. For such an amalgamation of different crystals to a single one the orientations of these crystals relative to each other must fit into certain conditions. Crystals which do not fulfill those conditions do not take part in the process of amalgamation. The neighboring crystals then grow together enclosing the misorientated one without absorbing it in their own lattice. Burgers started his lecture with an experiment which demonstrated how the diffraction of x-rays by a linear grating may be interpreted in its reciprocal space.

Although the problems were treated from a purely scientific point of view, without dealing with practical applications, it became obvious that the scientific results obtained are already of the greatest practical interest, e.g. as far as the mechanical behavior of the real crystal, or the light emission of crystals, etc. are concerned. This combination of scientific and practical interest found its expression in the large attendance as well as in the extended discussions which followed the different lectures.

—R. Brill and Hartmut Kallman

AAAS SYMPOSIUM ON PHYSICS

SEMICONDUCTORS AND FERROELECTRICS

Physics of the solid state was the subject of one of the four symposia on physics held at the AAAS meeting in New York City last December. Three talks were given on Friday morning, December 30, two of which were de-