in the same temperature-range. The results showed that the behaviour of some metals, notably of tungsten and molybdenum, which formerly had been considered anomalous because of a large relative increase in resistivity, can be explained if the high recrystallization temperatures of these metals are taken into account. Another observation was that, on wire-drawing and rolling, the electrical resistivity of some cubic metals becomes anisotropic. An analysis of the results indicated that the increase in electrical resistivity with deformation may not be caused entirely by dislocations and lattice vacancies, but that stacking faults in face-centred cubic crystals may also play an important part.

Mechanism of Phase Changes

There are two ways in which a transformation in the solid state may occur. First, the atoms may be rearranged to form a crystal of the new structure which has the same external shape as the original crystal. Such transformations involve nucleation and growth of nuclei, and depend on thermally activated diffusion. Secondly, the rearrangement of the atoms may occur in such a way that each atom has the same neighbours in the new structure as it had in the old. This leads to a change in external shape which produces relief effects on polished surfaces. These phase changes occur extremely rapidly, even at temperatures where the rate of diffusion is very small, and proceed only during cooling and not isothermally to any appreciable extent.

As for the mechanism of thermally activated diffusion, it appears that the movement of atoms is connected with that of lattice holes. The development of the theory may be assisted by investigating the effect of atomic packing on the rate of diffusion, and for this reason the rate of self-diffusion was measured in various directions in tin crystals; as these show anisotropy of the diffusion-rate and no chemical complications occur, since only one type of atom is involved. It was found that the activation energy for diffusion along the tetragonal axis was about one and a half times that for diffusion in any direction at right angles to it, and the geometrical factor was about forty times larger for the tetragonal axis. However, it has not been possible to correlate the activation energy with such other physical properties as are mainly determined by the energy with which the atom is bound to its equilibrium position in the structure.

The investigation of 'diffusionless' transformations is particularly attractive, as it is hoped that from their features the movement of the atoms during the transformation may be deduced. An attempt is now being made to determine the atomic movements in transformations which produce changes in external shape, although they occur by thermal diffusion. The fact that the orientation of the new crystals is related to that of the matrix suggests that the mechanisms by which nucleation-growth and diffusionless transformations occur may not be as fundamentally different as was previously thought.

The work described in this paper is the result of close collaboration of a number of workers, and it is difficult to disentangle the individual contributions. For this reason no reference has been made to particular publications.

OBITUARIES

Dr. R. W. Gurney

Dr. Ronald Gurney, who died at his home in New York on April 15 at the age of fifty-four, was born in Cheltenham and was educated at Cheltenham College. After service in the Gloucestershire Regiment in the First World War, he went to Cambridge, where he was an undergraduate at Trinity Hall. He began his career as a scientist at the Cavendish Laboratory under Rutherford, where he carried out experiments on the ionization by fast particles and published a number of papers on this subject. It was during a visit to the United States, however, that he made in 1929 the first of those striking incursions into theoretical physics by which he will be mainly remembered; in collaboration with E. U. Condon, he gave the first correct explanation of α-decay in terms of wave mechanics, anticipating by several months the similar but more detailed treatment of Gamow. From this time onwards he became a theorist; after some years at Manchester with W. L. Bragg, he came to Bristol in 1935 and worked with me. We produced jointly the book "Electronic Processes in Ionic Crystals", and also a theory of the nature of the photographic latent image, much—if not all—of which has stood the test of time. In addition, he worked on the theory of liquids, and in Manchester and Bristol he laid the foundation of his future work on ions in solution.

In 1941 Gurney went to the United States and worked first at the Ballistic Research Laboratories of the Aberdeen Proving Ground, then at the Argonne Atomic Laboratory, at the Johns Hopkins University, and finally at the University of Maryland.

Gurney's publications include the books "Elementary Quantum Mechanics" (1934), "Ions in Solution" (1936), "Introduction to Statistical Mechanics" (1949) and "Ionic Processes in Solution", recently published by the McGraw-Hill Book Co. It was typical of him that, though he could use mathematics as well as another, he never trusted it; no theory was a theory to him until he could grasp it intuitively and, above all, draw diagrams of it. In this he was among theorists perhaps the truest representative of Rutherford's school, and of the British tradition. Wherever Gurney went—and not least at Bristol—he contributed to the work of the place a capacity to see things clearly, graphically, and in their essentials. He was a man with whom it was a privilege to work, and from whose unique qualities of mind and character his collaborators could learn much.

In 1950 Gurney had a stroke, and although he recovered well he was advised not to incur the strain of regular lecturing. During his last three years he was able, with the constant help of his wife Mrs. Natalie Gurney, to devote himself to his last book, which has appeared since his death. His many friends and colleagues will look forward to another example of his unique ability to make the complex simple and to get to the heart of things.

N. F. Mott

Dr. C. E. M. Joad

Dr. C. E. M. Joad was reader in philosophy in the University of London and head of the Department of Philosophy, Birkbeck College. By his recent death, philosophy has lost one of its most lucid expositors and teachers. A list of his writings shows how wide were his interests. He was not satisfied until he had