FERRIMAGNETISM IN THEORY AND PRACTICE

Ferrites

Physical Properties of Ferromagnetic Oxides in Relation to Their Technical Applications. By J. Smit and H. P. J. Wijn. Pp. xiv + 369. (Eindhoven: Philips' Technical Library, 1959.) 72*s*.

THE history of the growth of our knowledge of ferrites offers an excellent example of the conditions which are becoming increasingly necessary for success in present-day physical research. Following Néel's original theoretical conceptions of ferrimagnetism, the study of these materials was carried on mainly in an industrial organization, furnished not only with the necessary technical prowess to ensure proper sample preparation and purity control, but also endowed with a liberal policy towards basic research. Alongside this work the key to a fuller understanding emerged from government-sponsored laboratories, by means of the technique of neutron-diffraction which had grown up as a by-product of the operation of nuclear reactors. As a result of this combined attack by physical, chemical and crystallographic methods, many of the properties of ferrites are now much better understood than those of the ferromagnetic metals.

Against this background Drs. Smit and Wijn give an account of the basic magnetic properties of ferrites, emphasizing the properties which are of importance for practical applications and with particular reference to the chemical composition and crystal structure of their materials. They emphasize that they are writing at an intermediate level for readers who are actively working with ferrites, and especially in connexion with their technical uses. As a result the opening chapters, which as Part *A*, "Theory", form almost one-third of the book, concentrate on explanations given in terms of simple physical models rather than strict mathematical demonstrations. Many readers will indeed welcome this and will find that these early chapters offer a very readable account of current conceptions in magnetism, viewed in a field much wider than that of ferrites and presented in an original manner.

Succeeding sections of the book are Part *B*, "Methods of Measuring the Ferromagnetic Properties", and *C*, "Intrinsic Properties", which considers in turn the three classes of ferrite with spinel, hexagonal and garnet structures respectively, and describes their chemical composition, crystal structure, saturation magnetization and crystalline anisotropy. One can complain that the garnet class—particularly those containing rare-earth oxides—get rather scant mention compared with the hexagonal group, where the authors do justice to Braun's elegant work which unravelled the structural secrets. In the last third of the book, Part *D*, entitled "Polycrystalline Ferrites", we come to the more purely technical data for the sintered polycrystalline product as normally handled, a macroscopic product the mechanical and electrical properties of which will depend on porosity and any crystallite orientation induced during the manufacturing process. An idea of the very comprehensive discussion in this section is provided by some of the section headings. There are, for example, sections on the frequency-dependence of the conductivity, dielectric constant, permeability and magnetization curve and on the effect of mechanical stress on the magnetic spectrum and the hysteresis loop. The data here, as indeed throughout the book, are presented very clearly in graphical and tabular form.

The book is excellently produced and pleasant to read, though perhaps with more than its fair share of trivial proofing errors which have escaped detection. As a personal feeling I must admit to a dislike of the system of referencing, using forms such as *Ab* 1 and *Ze* 1 which necessitate turning to the back of the book in order to discover the year of any particular publication. Finally—as a suggestion—the less-specialized reader, who may peruse a good deal of this book with profit, might welcome a few notes on the actual employment of ferrites in electronic devices.

G. E. Bacon

ENERGY FOR THE ATMOSPHERE

Turbulent Transfer in the Lower Atmosphere

By Dr. C. H. B. Priestley. Pp. vii + 130. (Chicago: University of Chicago Press; London: Cambridge University Press, 1959.) 28*s*. net.

THE meteorologist is vitally concerned with the rate at which energy enters or leaves the atmosphere at the surface of the Earth because this flux ultimately provides the major control on the behaviour of the atmosphere up to quite high levels. Momentum is also drained from the atmosphere at the surface; while man, beast and plant lives (or fails to live) in the layer of air immediately affected by these fluxes. They are mainly, for momentum and latent heat wholly, effected by atmospheric turbulence, except at the very boundary, and Dr. Priestley has written a monograph describing the present position of the study of these turbulent transfers. As the leader of a notable group on the subject near Melbourne over most of the post-war period he is admirably fitted to undertake the task.

Priestley begins at the stage reached by the subject in the early post-war years, as expounded by Sutton in his "Micrometeorology". He sets out to provide a coherent body of knowledge on the relation of the vertical fluxes of heat, matter (evaporation) and momentum to the 'external' parameters—the choice of these is quite a part of the problem, particularly as they are affected by the density or thermal gradient, or, from the other end of the telescope, by the heat transfer itself. The simplest condition, that obtaining when the transfer properties of turbulence are not significantly affected by buoyancy forces (non-adiabatic lapse-rate), is now moderately well understood and described, though the flux of heat or water vapour has not yet been adequately related to the actual surface temperature or vapour pressure. For heat, a second special case obtains when the transfer properties of turbulence are dominated by buoyancy forces to the exclusion of shear-engendered forces—the regime of free convection—and here Priestley's dimensional analysis of the problem and the observations of his group provide the required relations. In the general case, however, where both the above forces are effective and all the fluxes are concerned, theory is somewhat halting, but a framework for observation has been provided and the Melbourne observations of fluxes begin to fill the frame. If Priestley is correct, this general case is not of outstanding practical importance for