

exist in the ideal crystal. But it is becoming probable that impurities are only one means of producing such effects. Further, it may be, as Garlick states, generally assumed that, except in the case of manganese (in zinc sulphide phosphors), the activator occupies interstitial positions in the crystal lattice; but there is little evidence for it. Nor can it be agreed that by the use of the energy-band model good agreement, often of a quantitative nature, is obtained between experimental and theoretical studies. The model, at least as much as industrial requirements, has indeed stimulated investigations, but it has not yet provided satisfactory quantitative explanations. Its very attractiveness and fertility has led to a bewildering variety of plausible mechanisms.

It is now being recognized that a new approach is needed, and it is interesting to see that some of the work of Garlick and his colleagues is leading them back to a conception of the luminescent centre as a large complex containing the metastable levels associated with phosphorescence—a conception (though the author appears to be unaware of this) put forward some twenty years ago.

Within the chosen limits of selection, the book does provide a clear account of those parts of the subject in which the author is most interested—thermoluminescence, decay-rates and some possible mechanisms of phosphorescence. In the excellent survey of classes of luminescent materials, it is unfortunate that space could not have been found for the highly significant studies of Kröger and his associates, and of A. L. Smith on the effects of fluxes, and that Pringsheim's work on thallium-activated halides is dismissed so briefly.

The chapters on the electrical properties of phosphors and on infra-red effects are most welcome, since they collect, for the first time, many scattered experimental results, while those on cathodoluminescence and on organic molecules provide an up-to-date if brief survey of some recent work.

Altogether this is a book to be read with profit by all who are interested in recent developments and prospects in this puzzling and fascinating field.

J. EWLES

PHYSICS AND PHYSICAL CHEMISTRY IN BRIEF

Physics in Chemical Industry

By Dr. R. C. L. Bosworth. Pp. xix+928. (London: Macmillan and Co., Ltd., 1950.) 70s. net.

IN view of the fact that engineering may be regarded as applied physics, it seems strange that many engineers in Great Britain do not include in their training any physics beyond the intermediate standard. Chemical engineers, who must needs study physical chemistry, are somewhat better equipped, since physical chemistry and pure physics have many points in common; but students of both categories may well find on completion of their training wide gaps in fundamental knowledge which, one day, they may regret.

The appearance of a volume entitled "Physics in Chemical Industry" consequently aroused high hopes that the author had investigated the weaknesses of chemists and engineers engaged in industry and had written helpful articles to which reference might be made in case of need. Alas! this is not the case, unless the writer considers that industrial scientists

are in a state of abysmal ignorance. In the space of 700 pages he has endeavoured to cover a good deal of mathematics, the whole of physical chemistry, the properties of matter, heat and electricity, the latter in 28 pages under the title of "The Diffusion of Electric Charge", and a few shreds of chemical engineering. The result is a mixture of brief notes on subjects with which the average scientific worker is well acquainted, and somewhat more advanced articles which can be followed by those familiar with the special branch concerned. Several of the latter, particularly those of a mathematical type, are good; but it is doubtful if they could be absorbed by a student to whom the subject was new. One of the most perplexing things about the volume is the phrase in the title "in chemical industry". It is true that most of the subjects treated, if not all, are of vital importance to industry, but the gap between pure science and its application is not to be bridged by saying that such and such a theory is useful in industry or by uninformative illustrations of commercial instruments. For example, a brief but lucid exposition of some of the mathematics of vibration is followed by a very superficial account of a centrifugal machine, and no attempt is made to show how the equations just developed can be used to obtain quantitative figures for its performance. Those engaged in teaching are well aware that very few science and engineering students realize spontaneously the practical value of pure mathematics and formal physics; many of them are frankly bored by these subjects, and it is not until they have been shown how fundamental science can be used, by means of numerous examples carefully explained, that they start to take a real interest. The author states that his object in writing the book was to foster a closer relation between science and industry, but it is to be feared that his undoubted enthusiasm for pure science has relegated industry to the background.

The last 200 pages, entitled "Scientific Instruments", is of an entirely different character from the first part of the book. It is possibly intended for the "practical man" mentioned in the preface, as it deals with scientific instruments and measurements mostly in an elementary manner, but yet explaining the underlying theory and indicating sources of error. The "practical man" might, it is feared, be deterred from reading the section on controlling instruments by the definitions of controls in terms of Heaviside functions and, indeed, the whole of this section, owing to over-compression, is hard to follow and the nomenclature recently agreed upon is not adhered to. The other sections are fairly comprehensive and should be of considerable value, the best perhaps being that on temperature measurement.

It is remarkable to find in a work of this description no more than casual reference to electronic valves and circuits, the mass spectrometer, infra-red absorption, photoelasticity or modern theories of creep, to mention only a few items commonly used in industry perhaps without a full understanding of the principles involved. A possible explanation is that the book appears to have been completed in 1942, a few references being added afterwards, and that the subjects mentioned had not then assumed their present importance. It is evident that an immense amount of thought and care has been expended in producing this volume. Is it too much to ask for a revised edition with at least half of the subject-matter omitted and the remainder carefully co-ordinated with industrial applications? H. E. WATSON