

the substitute symbol  $L$  in a companion figure; also, improper labeling of figures occurs twice in Chapter 7, which could cause needless difficulty to a reader who is uncertain about the subject). Only a few outright technical errors exist in this book, such as propagation of the fallacy that antimony expands on freezing as do the other substances with 'anomalous' nucleation behavior such as water, gallium, and bismuth.

The author occasionally makes simplifying approximations in the course of deriving certain theoretical equations that he presents with ostensible general validity. For example, in his derivation in Chapter 5 of the steady-state form of the theory of constitutional supercooling, the author justifies elimination of certain terms by stating without restriction that, compared with typical chemical diffusivities (in liquids) which are of order  $10^{-5} \text{ cm}^2 \text{ s}^{-1}$ , the thermal diffusivities will 'typically be of the order of unity in the same units', a statement which is true only approximately for the most conductive metallic materials, and which clearly should be qualified for the reader who might not be thinking of metals when using the results.

In summary, this book will make a useful addition to the reference shelf of scientists and students concerned with crystal growth and solidification processes. A well edited second edition should be published in the near future, since the field is undergoing rapid advances at present.

M. E. GLICKSMAN

*Naval Research Laboratory  
Washington  
D.C. 20375 U.S.A.*

**Oxide semiconductors.** By Z.M. JARZEBSKI; translation edited by B.R. PAMPLIN. Pp.xi+285, Figs. 195, Tables 39. Oxford: Pergamon Press, 1974. Price £6.00.

This book presents a useful and timely survey of the oxide metals and semiconductors, an important group of electrical materials which are becoming increasingly prominent in electronic and solid-state devices. Largely because of their more complex chemical and crystallographic structures in comparison with the more simple elemental and compound semiconductors, together with the relatively greater technical difficulties of the preparation of single crystals of oxide materials with the requisite high perfection and purity, their wider application in electronics and electrical devices has been somewhat restricted. As with the initial development of the elemental semiconductors, the theory and basic understanding of these materials appear to be somewhat ahead of their technology. However, with the more recent mastering of single-crystal growing techniques and thin-film preparation, the situation is rapidly changing and rapid progress is now being made in the technology of the oxides both in bulk-crystal and thin-film materials.

The book is divided into three main parts which in turn are subdivided into chapters and sections with a total of fifteen chapters. Many of the chapters, however, are very brief, some being only 5 or 6 pages long. This is perhaps a little unfortunate because it tends to leave the reader with the impression of a rather superficial treatment of the subject, a criticism which certainly does not apply to the

book as a whole. Parts I and II present a comprehensive (though brief) summary of the theoretical and experimental aspects of the subject as the necessary groundwork essential to the understanding of Part III, which is not only the longest section but, from the point of view of the research worker and the serious reader, the most valuable and informative part of the book.

In Part I very brief thumb-nail sketches are given of most of the known methods of oxide material preparation, the various techniques for growing single crystals and for the preparation of oxide thin films. The more essential details of the experimental methods have been highlighted by means of some very helpful diagrams. As stated in the Introduction, to understand the electronic processes in crystals which are subject to deviations from stoichiometry and to be able to control their properties the roles of defects must be thoroughly understood, and in Part II these are discussed in some detail. After an elementary treatment of point defects and dislocations in crystals and the application of the law of mass action, a brief introduction to the electron band theory is presented. Various theoretical expressions are stated without derivation as, for example, the density of energy states and the charge-carrier concentration in a semiconductor. Although the arguments can be readily followed by the student with a background of solid-state theory, the general reader would be well advised to refer to the standard texts on the subjects. Although the problems of defect equilibria in pure crystals have been considered for only a limited number of selected situations, the conclusions are of a general character and can be confidently applied to other combinations of defects and the phenomena associated with them. The symbolisms used by the author in discussing defect equilibria may be a little confusing to some readers, mainly because of the necessity of having to search for the original definition of a specific symbol.

From the point of view of new material and information Part III is perhaps the most important section in the book. After a brief outline of the theory of electronic and atomic transport phenomena, the results of the research on a number of selected oxides of technological interest and importance, undertaken over the 15 years prior to 1972, are presented. As an example, NiO, as representative of the 3d transition metals, is discussed in some detail with the aid of numerous graphs and tables of experimental results. From the point of view of their technical application in solid-state electronics and other areas, the more promising metal and semiconductor oxide materials are reviewed and the current information on their properties and behaviour given.

This book emphasizes yet again what has been known since the discovery of the transistor in 1948, that the progress and future of electronics is essentially limited by the advances in understanding of materials and particularly materials technology, crystalline perfection and impurity control, rather than by our basic understanding of device principles. In compiling this survey over 600 references have been collected and these add considerably to the value of this book as a most useful reference for research workers and students in this very important and expanding field of oxide semiconductors.

R. G. RHODES

*Department of Engineering  
University of Warwick  
Coventry  
Warwickshire CV4 7AL England*