Imperfections in Crystals. By H. G. Van Bueren. 676 pp. (North-Holland, Amsterdam) Interscience Publishers, Inc., New York, 1960. $16.75. *Reviewed by R. Smoluchowski, Princeton University.*

THE main reaction to the book is an admiration of the author's courage in tackling the seemingly intractable field of crystalline imperfections. The reviewer knows of several overoptimistic authors, including himself, who blithely embarked upon manuscripts dealing with this subject and soon gave it up. The present book fulfills admirably the goal which the author set himself. To use his own words:

> The attention in this book is primarily focused on the phenomena related to the *physical* lattice imperfections such as dislocations, vacancies, interstitial atoms, and on their combinations, e.g. vacancy pairs and larger clusters of point defects, dislocation arrays such as grain boundaries, etc. It did not seem practical also to include in the book a discussion of *chemical* imperfections in crystals. Consequently, the variety of effects that are caused by the introduction of foreign atoms (in more than very small traces) are not systematically dealt with. For instance, the phenomenon of fluorescence remains undiscussed, the fluorescence of crystals being intimately related to the presence of foreign atoms. Again, the important electrical properties of donor and acceptor elements in the semiconductors germanium and silicon are only briefly mentioned and not treated in detail. Even those phenomena peculiar to metallic alloys, such as ordering processes, nucleation and growth of precipitates etc., are only very briefly described.

Similarly certain electronic imperfections are omitted. The omissions and limitations of the scope of the book are justified by the existence of rather full treatments elsewhere. This choice permitted the author to fill the biggest gap in the broad spectrum of imperfections literature in a highly satisfactory manner. One might perhaps question the relative amounts of space assigned to various topics or point out misprints or incomplete references, but to dwell upon these minor drawbacks would be out of place in comparison with the positive qualities of the book. The book is written without the need for theoretical sophistication on the part of the reader and is therefore suitable as a reference for a wide variety of scientists and engineers. It is also eminently suitable as a base for a course in a curriculum in the now suddenly popular "materials sciences" (whatever this term is supposed to mean). Excellent illustrations and many references add to the value of the book which is heartily recommended to all inquiring minds.

An Introduction to Statistical Thermodynamics. By Terrell L. Hill. 508 pp. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1960. $9.75. *Reviewed by J. Gillis, The Weizmann Institute of Science.*

THERE is at least one distinguished precedent for the idea that an author, having produced a difficult and excellent book on statistical mechanics, should follow it with an excellent but easier work suitable for the use of chemists. And comparison of the book under review with Fowler and Guggenheim brings out quite dramatically the enormous increase in the range of problems which have since been brought within the domain of statistical mechanics.

Prof. Hill's work is intended for chemists, but many of these may find it somewhat difficult going. However, provision is made even for them. The material has been skillfully chosen and judiciously arranged, so that courses of varying degrees of difficulty can be built up by selecting appropriate sections of the book. Three such courses are suggested in the preface, but an experienced teacher could easily make up many more and adapt them to the needs (and capabilities) of his classes.

Part 1 of the book is devoted to a careful exposition of basic postulates and ideas, starting from ensembles and leading up to the third law of thermodynamics.

Part 2 deals with systems composed of independent molecules or subsystems. The coverage is not intended to be complete, but the selection of problems dealt with is sufficient to bring the reader within reasonable distance of most of the subject. The mathematical treatment is simplified as far as the facts of nature can possibly permit, while adequate and up-to-date references are given to more sophisticated work. The subjects include not only such standard problems as ideal monatomic, diatomic, and polyatomic gases, specific heats and vibrational frequencies of crystals, and chemical equilibrium and reaction rates in ideal gas mixtures, but also some less usual topics, such as the behavior of an ideal gas in an electric field.

Part 3 covers systems of interacting molecules. Here the mathematics becomes harder and the selection of topics necessarily less complete. The actual choice of what to put in must have posed quite a problem for the author, and he is to be congratulated on the result. There is a discussion of lattice statistics, but almost entirely from the approximate point of view. For the more exact mathematical treatment of Onsager and others, the reader is referred to Hill's *Statistical Mechanics*. Imperfect gases and their virial expansions follow. Liquids, and especially dilute solutions, take up the next four chapters. All the useful approximate theories are given, the Debye-Hückel theory of electrolytes and Kirkwood's theory of solutions in some detail. This is especially welcome since the concepts are of great interest in the study of plasmas, a problem of such wide current attention. The business part of the book ends with a discussion of concentrated solutions, polymer and polyelectrolyte solutions, and gels.

The last chapter, on quantum statistics, is by nature more of an appendix and is followed by seven further appendixes on various special mathematical topics.

In a book of this sort there is always the difficulty of judging how much mathematics to put in. There is indeed the danger of giving enough to bewilder the nonmathematician while still failing to satisfy the