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New Books

E. A. Guggenheim. *Thermodynamics, An advanced treatment for chemists and physicists.* North Holland Publ., 1949. – 395 pp. fl. 20. ≃ £2.

Readers and admirers – which may cover just about identical assemblies – of Prof. E. A. Guggenheim's "Modern Thermodynamics" from 1931 will be eager to see his new book, and they will find that nothing has been lost of the lucidity and exactness which made that book one of outstanding merit. Several new fields are now covered with equal clarity, and many of the interventions, with which Guggenheim has in later years cut through inexact usage are now worked into the text.

As might be expected of a modern treatise, the book includes also a "Digression on Statistical Thermodynamics". The presentation is essentially that from the paper by Guggenheim at the "Kemikermøde" in Copenhagen 1939. Extensive use is made of the "Massieu-function" $J = -F/T$ and the "Planckfunction" $Y = -G/T$, convenient for statistical work.

It is an "advanced treatment" also in the respect that the reader should have some knowledge of statistics in order to understand this chapter, and as a whole the book is rather more "advanced" than "Modern Thermodynamics". The question is whether or not this is an indispensable consequence of the clarity and exactness. In other words: Do inexactness and obscurities really make a text easier or more elementary. The reviewer thinks not and would welcome an elementary text on the same lines as the present book, although it would necessarily be either more restricted or rather much bigger. But as it is, this book as a matter of course will take its place on the shelves of any physical chemist who want an easy source of information on how to elucidate a thermodynamic problem without bringing in any kind of nonsense.

The book is well produced but has rather too many misprints. An index would have made it more convenient as a reference book, but an extensive table of contents makes up for it to some degree.

J. Koefoed

Walter Hückel: *Anorganische Structure Chemie.* Enke, Stuttgart, 1948. Price DM 68: –, bound DM 71: 20. 1013 pages, 170 figures.

The title of this book reminds one of two other works: "*Structural inorganic chemistry*" by Wells, and the "*Strukturbericht*" of the *Zeitschrift für Kristallographie.* However, on reading it we find that it cannot be compared with either. It is not a text-book like Wells' book, where the reader is supposed to start on page 1 and read on, steadily increasing his wisdom, but rather a collection of quite independent essays, sometimes giving elementary information, but in other parts demanding considerable knowledge on the part of the reader. Nor does Hückel try, like Strukturbericht, to give a complete list of all inorganic crystal structures

determined; however, in the course of his discussion he happens to cover a very great number of inorganic structures. So, if you are interested in some particular structure, you have a good chance of finding a reference to it in the index of Hückel's book.

The common theme in all these essays is the way the atoms bind each other in inorganic compounds. In the preface the well-known author of the *Theoretische Grundlagen der organischen Chemie* gives an account of the various paths that led him to this theme, and how he began to feel the need for a comprehensive treatment from the stand-point of a chemist, as distinguished from that of a theoretical physicist or a crystallographer. The field is certainly wide and far from completely mapped, so that when a man of intelligence and wide experience tries to make a survey of it, there will inevitably be much to learn.

The first two chapters are historical reviews. Hückel has made a great effort really to penetrate into the ways of chemical thinking at the various times. This is very inspiring; the reader of many other histories of chemistry may be tempted to judge the scientists of past centuries by the standards of our own time. It is a common mistake to think that many of our present concepts were known even in former days and that the only thing needed was the genius to find out experiments to prove the concepts. The truth is, of course, that even the concepts were not yet conceived. In comparision with the usual panegyrics, Hückel's revelations of the shortcomings and mistakes of great scientists may seem heartless; however, they bear out this point very well.

The subsequent chapters discuss special topics. In several places the reader is reminded of one difficulty which is not always clearly understood, namely that of the accuracy of interatomic distances. In a crystal structure determination it is usually easy to determine very accurately the positions of the heavy atoms. However, the positions of the light atoms have a rather small influence on the X-ray intensities and thus cannot be determined very accurately from intensity data alone. Generally one has to use other arguments too, such as reasonable assumptions on the interatomic distances or on the type of coordination. If, for instance, an author states the distance A — X to be 1.67 Å it does not always mean as it should that in the compound studied this distance is certainly within the limits 1.67 ± 0.01 Å. Very often the author would readily admit that his experimental material alone would not permit a higher accuracy than, say, 1.7 ± 0.2 Å, but that he has arrived at the figure 1.67 Å by certain theoretical assumptions about the coordination and distances. If, now, the author of an article surveying the field uses such an "accurate" figure as a proof of those theoretical assumptions, he is obviously running around in a *circulus vitiosus*. Admittedly it is very hard for the author of the survey to check up such things, so one must wish that the original authors would state the real accuracy of the interatomic distances more explicitly than is now the practice.

The third chapter treats the theory of coordination compounds. A large number of facts from the "classical" complex chemistry are recorded, but seen from a modern stand-point. For instance, the differentiation between primary and secondary bonds (Haupt- und Nebenvalenzen), which — perhaps because of mental inertia — is often found even in recent literature, is here done without.

Chapters 4—6 treat the periodic system, the structure of atoms, experimental methods for investigating the chemical bond, and the different types of chemical bonds. Some readers may find these chapters a useful repetition. Others may

prefer to read some more elementary treatment.

Chapter 7 is on volatile inorganic compounds such as hydrides, halogenides, and carbonyls, and on what makes some compounds volatile, and others not.

Chapter 8, on crystal chemistry, treats among other things the causes of polymorphy, and phase diagrams. It is good to find that Hückel is sceptical on many points where others are cock-sure.

The next three chapters treat silicate chemistry, glasses (even non-silicate glasses), metals and alloys, and rates of reaction; in the last, of course, Hedvall's school is quoted repeatedly. Chapter 12, the last one, tries to map the trends of chemical research through the centuries.

Of course, when a number of originally independent essays are compiled into a book, it is hard to get a really homogeneous product. Sometimes one is surprised at the choice of details, *e.g.* the very detailed prescriptions for the preparation of certain compounds. In some parts of the text we find the wordiness that characterizes a successful and even inspiring lecturer, but which can be considerably cut down in a written text.

In writing this book, Hückel has not had access to a vast amount of work done in other parts of the world after 1939. It is also quite natural that he has happened to overlook a few older papers. There would be no point in making a list of such cases. However, if we consider that the book was written in Germany soon after the end of World War II, we must admit that it is an admirable one.

Certainly those interested in structural chemistry will find in it many facts and many new view-points.

Lars Gunnar Sillén