

those parts that do not adequately represent the best modern views.

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Reaktionen in und an Festen Stoffen. By KARL HAUFFE, Zentralinstitut für Industrielle Forschung Blindern, Oslo. Anorganische und Allgemeine Chemie in Einzeldarstellungen Herausgegeben von G. JANDER UND W. KLEMM. Band II. Springer-Verlag, Reichpietschufer 20, Berlin W 35 (West-Berlin), Germany. 1955. xi + 696 pp. 16.5 X 23.5 cm. Ladenpreis: Ganzleinen DM 78.-.

This book is the second in a series of monographs in general and inorganic chemistry under the editorship of G. Jander and W. Klemm. It contains extensive and detailed treatment of numerous solid state reactions selected from the recent literature in this rapidly developing field. The author has chosen to omit descriptions of many interesting technical processes so that a thorough discussion of his selected examples would be possible.

Many of the several hundred figures appear to be based directly on the original literature, reference to which is cited. Each figure is accompanied by a discussion which in the main is built around the Schottky-Wagner disorder theory which the author says runs through the entire book like a red thread. It is pointed out that Jost in 1937 first used this theory for a comprehensive presentation of processes fundamental to solid reactions.

The Schottky-Wagner theory as described is based on three assumptions necessary to electroneutrality: (1) An excess of metal over the stoichiometric composition is to be considered as an excess of cations + quasi-free electrons; (2) an excess of anions over the stoichiometric composition is to be considered as an excess of anions + electron holes; (3) an excess of B (especially in mixed metal phases) occupies, here and there, lattice positions of component A. In the first assumption two cases arise: (a) the cation excess is possible because a few places, here and there, in the anion lattice are unoccupied; (b) the cation excess may occupy interstitial positions. In the second assumption two cases arise: (a) the anion excess occupies interstitial positions; (b) the anion excess is possible because a few places, here and there, in the cation lattice are unoccupied.

The theory has been expanded, where necessary, to treat recently obtained data. For example, it was found possible to apply the Wagner oxidation theory at high temperatures but the theory lost its validity at medium and low temperature due to the formation of thin oxide films and it was necessary to develop a new theory. This has been done by Mott and Cabrera and by the author and his co-workers. The presentation is mathematical throughout but at places a rather generalized treatment has been used which the author hopes will enable persons with less mathematical training to apply the various diffusion equations.

Following the introduction, the various chapters deal with disorder phenomena in ionic crystals and in semi-conducting crystals; disorder and electric behavior in ionic and valence crystals; semi-conducting crystals and chemisorption; diffusion processes in solid materials; oxidation processes in metals and metal alloys; the mechanism of the formation of ionic compounds of higher order by means of reaction in the solid state; reduction and roast processes.

The importance of nuclei formation to crystal growth is not considered because of a recent comprehensive presentation of this material by I. N. Stranski and co-workers. Ordered precipitation (epitaxie) has likewise not been treated because of a recent publication on the subject by A. Neuhaus.

In his closing remarks the author points out that he has attempted to make a practical selection of solid state reactions for discussion but that the many new situations that are developing require that the solid state chemist and the solid state physicist concern themselves especially with 1. the real structure of the crystal, 2. the thermodynamics and kinetics of the building of crystals from ions and electrons and 3. physicochemical characteristics of crystals. In the last paragraph the author expresses his belief that there is scarcely an industry that is not touched in some way by solid state reactions and that therefore fundamental research in this field is of great industrial importance.

It is the feeling of this reviewer that the author has, in the main, achieved his purpose although one could wish that a more thorough treatment could have been given to work originating outside of the author's geographical area. The author and publishers should be congratulated on a monumental piece of work well done.

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