

BOOK REVIEW

The Chemisorptive Bond. By ALFRED CLARK. Academic Press, New York, 1974, vii + 207 pp. \$18.00.

When reading a new textbook or monograph it is perhaps instructive to pose the following questions: (1) Why was the book written, i.e., what useful purpose will it serve? and (2) For whom was the book written? After reflecting on these questions vis-à-vis *The Chemisorptive Bond: Basic Concepts*, I infer that the motivation for the book was to introduce students (advanced undergraduates and perhaps first year graduate students) as well as industrial researchers to the current theories underlying a description of the chemisorption bond. It is my opinion that the text is, at best, only a partial success.

The first few chapters seek to draw analogies with diatomic molecules considering both covalent (Chapter 2) as well as ionic bonds (Chapter 3). The mathematical rigor of these chapters (and indeed the entire text) is at a disappointingly low level. Chapter 4 represents a short and probably needless review of the band theory of metals followed by a qualitative and unfortunately quite simplistic discussion of *d*-band alloys and chemisorption thereon. In Chapter 5 a discussion of the two-band solid is given including the band structure of semiconductors and insulators, and the boundary layer model of chemisorption on semiconductors. There is essentially no more information here than can be found in Clark's excellent previous text *The Theory of Adsorption and Catalysis* (Academic Press, New York, 1970), and another presentation at this elementary level would appear difficult to justify.

Chapter 6, which gives an account of surface states on solid surfaces, is perhaps the best chapter of the book; but even so it ignores many important contributions in this active area of research which appeared prior to 1972, and no post-1972 work is referenced at all. It is also somewhat surprising that no mention is made of the important experimental probes which can be brought to bear on the problem of detecting surface states, e.g., uv photoemission (UPS), field emission energy distribution (FEED) measurements, ion neutralization spectroscopy (INS), and inelastic electron tunneling spectroscopy (IETS). Chapters 7 through 9 deal with the quantum theory of chemisorption on general lattices, metals and ionic surfaces,

respectively. A discussion of these topics is certainly an admirable idea, but again the lack of mathematical rigor has made them less effective than they otherwise could have been. The final chapter is a rather bland review of crystal- and ligand-field theory and its qualitative application to chemisorption.

The best feature of this book is that it presents a compilation of facts and many useful references concerning the theory of chemisorption and the chemisorption bond. On the other hand, a weakness of the text is that the author presents the facts with very little documentation, criticism or even comment. To cite but one example, the crystal- and ligand-field discussion of Chapter 10 is quite similar to that previously given by L. E. Orgel in *An Introduction to Transition-Metal Chemistry* (Methuen, London, 1960). In short, there are very few original contributions in the text; perhaps the presentation of this material would have been more appropriate as a review article considering the rather short length of the book and the fact that many of the more elementary notions could probably have been omitted. Moreover, most of the references cited in the text are of the pre-1971 vintage, so that this review of a rapidly progressing research field is very nearly dated immediately after its publication. This may well be unavoidable with any book describing chemisorption, but it is difficult to imagine such a text which does not discuss the theoretical work of J. W. Gadzuk and J. R. Schrieffer and the experimental work of D. E. Eastman (UPS) and E. W. Plummer (UPS and FEED). These should merely be construed as examples; there are many other conspicuous omissions of work which could and probably should have been mentioned.

In summary, the idea of writing a book describing the state-of-the-art of knowledge regarding the chemisorption bond is a sound one, and in the current absence of any competing text this one will certainly fill a need. However, it appears that the authoritative book in this narrow, but yet very important area of science remains to be written.

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