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BOOK REVIEW

Solids and Surfaces: A Chemist's View of Bonding in Extended Structures. By ROALD HOFFMANN. VCH Publishers, New York, 1989. x + 142 pp. $24.95.

To paraphrase a well-known philosopher, things are only interesting in that they are related to other things. Such a statement might well describe Roald Hoffmann's approach to his profession. His more recent writings have sought commonality between the arts and the sciences and in the past 25 years he has effectively built bridges between organic, inorganic, and organometallic chemistry. Most recently, he has forged links between these areas and solid-state chemistry. This book, a survey of this last connection, is a meld of two review articles appearing in *Angewandte Chemie* and *Reviews of Modern Physics*. That they were written at all is, at first sight, a little surprising since Hoffmann seldom writes review articles, preferring instead to influence the chemical and physical world through the primary literature. However, on reading this little book we see, more than anywhere else, Hoffmann the teacher. He shows us, using the little cartoons and chemical hieroglyphics which have become his trademark, how to understand the electronic structures of solids via the vehicle of molecular orbital theory and its solid-state analog, the tight-binding model. The language of this book though is the language of the molecule, what Hoffmann calls "the heart of chemistry," and the way in which he generates the energetic and descriptive features of energy bands is very similar indeed to the way chemists have learned to construct and understand the energy levels of molecules.

His book is an excellent place for both the beginning and the serious student of the solid state to learn about the electronic structure of both solids and surfaces from a perspective that is not traditional for solid-state chemists. Although there are a couple of areas where the discussion gets a little heavy going, Hoffmann takes his audience smoothly through the ideas of band construction for both solids and surfaces and then effectively demonstrates how we may use them. He spends some time showing where the electrons are in such a delocalized model and studies the Peierls distortion and the energetics of chemisorption using several tricks to help us fathom the essential ingredients of the electronic structure of some quite complex solids. One of these is the Crystal Orbital Overlap Population Curve, a device invented in his group and one which he skillfully uses in several problems. This book should be essential reading not only for practitioners of solid-state chemistry but also for molecular chemists who will see the myriads of connections between their trade and the realm of the solid state.

Hoffmann's book with its emphasis on band theory is a classic piece. Molecular orbital theory is introduced to chemists as freshmen or earlier and is a vital part of the culture of chemistry. His vivid demonstration that it may be used to understand the way solids are assembled provides a unifying part of the scientific puzzle. But the book also plays another crucial role by prompting us to ask questions about the other side of the electronic coin, where band theory is inappropriate or is only a part of the story. The adaptation of these ideas to this part of solid-state chemistry is surely one of the challenges which faces us in a more global understanding of the nuances of the solid state.

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