connected is not new. What would be innovative is a study like Moosman's, of their relation from both idealist and materialist perspectives. Only from such studies which provide quantified data can general principles be extracted to bridge some of the gaps between the realities of death and visions of the afterlife in Pre-Columbian America.

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Surfaces of Solids

Surface Physics of Materials. J. M. BLAKELY, Ed. Academic Press, New York, 1975. Two volumes. Vol. 1. xiv pp. + pp. 1–278, illus. + index. $29. Vol. 2. xiv pp. + pp. 279–548, illus. $27. Materials Science and Technology.

Surface physics and chemistry are old subjects. In their long history, they have grown in a rather haphazard way. They lack coherence and have been plagued by an unusually large collection of poor experiments, wrong data, and occasional bad theories.

The present sophistication of solid state physics and chemistry and the pressing need of today's technology to develop materials for chemical, engineering, electronic, and manufacturing purposes has accelerated the rate at which surface research has been moving. The motion, however, has not always been forward, and keeping up with the literature—and, of course, distinguishing the good from the bad and the right from the wrong—is a very difficult task.

The present book of ten chapters on the different aspects of surface research is intended to be a critical review that "attempts to predict the most profitable avenues for future research." The authors "are all individuals who have made substantial contributions to the development of [the] areas about which they have written."

I found the subjects and the authors very well chosen. The subjects range from the generally important and somewhat stalemated subject of surface crystallography, through electronic structure and transport, statistical thermodynamics of surfaces, and surface vibrations, to chemical analysis of surfaces and adsorption, segregation, and chemisorption on surfaces. The omission of magnetism and magnetic properties of surfaces is not easy to understand, but it does not mar the quality and the usefulness of the rest of the book.

I found particularly appealing the emphasis on the new physical and chemical methods for studying surfaces. For example, low-energy electron diffraction, the various forms of photon spectroscopy, ionization spectroscopy, atomic beam scattering, and ion mass spectroscopy are repeatedly discussed in connection with the various aspects of surface research. The reader can easily gain a realistic view of the present state of the art. He can also, through examples and reports of controversies, infer some of the limitations entailed by these methods.

In a similar way, the theoretical aspects of surface research are presented in bits and pieces, mostly from a subjective and rather partial perspective, but the book as a whole provides a fairly comprehensive view of what is being done and what lies ahead.

The presentation of the book is generally satisfactory, although it is sprinkled with misprints. Its illustrations are many and useful, but I find it annoying that they have been reduced in size in a completely random way, so that some complicated figures are too small to convey useful information and some trivial one-line graphs occupy three-quarters of a page. These are, however, minor irritations in a useful book.

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Macromolecules

Ionic Polymers. L. HOLLIDAY, Ed. Halsted (Wiley), New York, 1975. xii, 416 pp., illus. $43.50.

This book is a collection of eight contributions by 11 authors. It treats a specialized branch of polymer science that can be said to be quite new, the study of polymeric molecules containing ionic or salt groups. The subject matter encompasses a wide span of structures, from the wholly inorganic silicates and phosphates to the largely hydrocarbon-like ethylene-acrylate copolymers. The editor, Holliday, claims that the book attempts to produce a systematic and integrated picture of the ionic polymers, both organic and inorganic, and, in my opinion, the attempt has been largely successful. In an introductory chapter, Holliday provides an overview that serves very well to put the succeeding chapters in context. An important feature of the book is its insistence on treating wholly inorganic materials such as polyphosphates and polysilicates in terms familiar to polymer scientists who are mostly concerned with organic molecules. In this connection, the chapter by H. H. Ray on inorganic glasses as ionic polymers is especially instructive.

The chapter by Ruskin Longworth on ionomers deserves mention. The term "ionomer" is used generically by the Du Pont Company to describe polymers consisting of a hydrocarbon backbone and pendant acid groups. These groups, which may be carboxylic acids, sulfonic acids, or others, are neutralized partially or completely with various cations. Some of these ionomers have taken on considerable commercial importance, particularly in coating applications, where their optical clarity, outstanding toughness, and good adhesion to high-energy surfaces make them perform better than conventional coating materials. Longworth presents a comprehensive summary of the considerable body of work that has been done on ionomers, from preparation and characterization to studies of structure, morphology, and rheological properties.

The systematic investigation of the properties-structure relationships in ionic polymers is at a very preliminary stage of development. This book points up this fact with striking clarity and provides the first comprehensive guide for the exploration of this largely unknown territory.

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(Continued on page 1291)

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