

The book thus provides an extremely valuable and timely synthesis of the present state of the many aspects and methods of study of environmental history in the Late Cainozoic. All the fields of research represented are advancing rapidly and workers in Quaternary research will be indebted to the organizers of this colloquium for providing them with a stimulating survey of recent achievements and prospects in the elucidation of Late Cainozoic Earth history. R. G. WEST

Gas/Metal Interface

Chemisorption and Reactions on Metallic Films. Edited by J. A. Anderson. Vol. 1: Pp. xii+555; £11; \$32. Vol. 2: Pp. xii+323; £7; \$21. (Academic: London and New York, August 1971.)

THESE two volumes comprise nearly 900 pages and cost £18 for a text that is well produced, except that almost every international convention regarding abbreviations, units and the printing of physical quantities in italic (or sloping) type, has been disregarded, and none of the authors has used SI units.

A book of this title fulfils a need and its appearance is timely. Its purpose is to describe with some degree of coherence and continuity the contributions to our understanding of the chemistry of the metal/gas interface in relation to the structure of metal films. The objective has only been partly achieved, because many of the authors have written about the topic of the chapter heading and have forgotten the principal title of the book. There is, in consequence, much valuable information about the formation and structure of films, and also about the chemisorption of gases on metal surfaces, but little correlation between these two groups. Each author has apparently been largely unaware of the contents of the other chapters, so that there is a fair measure of overlap and no overall coherence.

Scientists should first judge the relevance of the material about which they write and secondly express themselves concisely. There is little advantage to the reader in being presented with a series of review articles containing a large amount of descriptive detail both about the results and the workers who obtained them. Some judgment and critical assessment, even if biased, of the present status of the art are surely preferable.

In this respect, D. F. Klemperer's article is scholarly and critical; and he provides a well-organized account in admirably concise prose, yet the chapter is still extensively and well documented. The material is aptly chosen and is indeed directed to the use of metallic films as a primary consideration. J. V.

Sanders in his chapter on structure of evaporated metal films has also the interests of experimental surface chemistry in mind by concentrating on structure in relation to the deposition parameters in film preparation and he provides guide-lines for the control, at least in part, of porosity, grain size, the quality of epitaxial layers and so forth, while emphasizing that it is by no means clear what conditions of preparation will produce either facets of close-packed atoms, or randomly oriented surfaces with kink and ledge atoms; and their surface properties may be quite different.

In contrast, the two long chapters by J. W. Geuss on fundamental concepts in film formation and on the influence of adsorption on electrical and magnetic properties are expansive reviews, written in verbose style. Judged in isolation, these chapters contain much good material and have considerable merit; in terms of the chief theme of the book, one must question the relevance of much of its contents. It requires ingenuity to transpose information about migration of metal atoms over a field emission tip, or the thermal accommodation of such atoms on the cleavage plane of an ionic crystal, to the problem of chemisorption of a gas on metallic films. Many people have doubts about the assessment of conductivity results on films and of their theoretical interpretation in terms of adsorbate-adsorbent bonding, so that in terms of the price of the present volume, a much shorter chapter could have been more appropriate.

D. O. Hayward in his chapter on gas adsorption clearly has an important task to perform. Except for some short sections on heats of chemisorption and desorption spectra of gases from metallic films, he has largely confined attention to an undefined metallic plane or to specific planes of metal crystals. He panders to convention by a necessarily superficial account of band theory, and then reverts to localized band concepts and surface geometry as an explanation of different adsorption states. The recent literature is well reported but the reader is given little help in understanding the significance of the wealth of detail presented. With greater selectivity and better organization, and a more concise style, an even more valuable contribution would have resulted.

In the final chapter in the first volume on infrared spectra of surface species, J. H. Little provides an abbreviated version of his 1966 book. The contributions of Greenler, both theoretical and experiment, on the multiple reflectance technique, and the interferometric studies of Low, are, however, included. Nevertheless, the impression gained is that one should concentrate on oxide

surfaces in order to exploit more fully this technique.

J. Anderson (the editor) and B. G. Baker contribute the first two chapters in the second volume on adsorption, kinetics and surface structure and catalytic reaction on metal films. In the first chapter, a concise relevant account of structure, porosity, sintering and heterogeneity of films is followed by a good outline of equilibrium adsorption and rates of adsorption on a uniform surface as an introduction to an extension to heterogeneous surfaces. It has not been possible to treat reaction with films in an explicit manner, but at least the problem has been posed and recognized.

It is extremely difficult to write about catalytic reactions; the experimental data are varied and irreproducible, and to provide any general coherent theoretical account is not really possible. The reactions chosen are: exchange, hydrogenation, hydrogenolysis and skeletal isomerization, and oxidation and dehydrogenation. They are treated at a phenomenological level in an attempt to give a general understanding of the nature of catalytic reactions on metal surfaces and a guide to the vast literature on this subject; in this sense, the contribution is a valuable and successful one.

The final two chapters deal with the properties and reactions of alloy films by D. R. Rossington, and oxidation of evaporated films by I. M. Ritchie. The first of these is a very good article and is directed throughout to films. The preparation, characterization and structure of films, with particular reference to the composition of the surface, are reported competently before the sections on the surface properties and the catalytic activity in parahydrogen conversion, oxidation reaction and ethylene hydrogenation. The material has been well organized, selected with judgment, and presented with clarity.

Ritchie has written an interesting and critical chapter—it has a freshness, largely because of its selectivity and critical approach. Oxidation of metals precedes that of films; the limited information derived from purely kinetic relationships is emphasized and other approaches are examined. The concepts are then discussed in relation to films and the further restrictions on the interpretation of results by the film structure qualitatively examined in a workmanlike manner.

In conclusion, although the chief purpose of the book has only been partly attained, surface chemists interested in the gas/metal interface and in metallic films should use all their persuasive powers to ensure that a copy of this book is available in an accessible library. F. C. TOMPKINS