Material Concepts in Surface Reactivity and Catalysis

Henry Wise and Jacques Oudar
(Academic Press, 1990, 260 pages)
ISBN: 0-12-759940-1

With their book, *Material Concepts in Surface Reactivity and Catalysis,* Wise and Oudar have produced a unique contribution to the legion of publications that dwell on surface science and catalysis. They begin by addressing the salient properties of bonding and structure in bulk crystals and at crystalline surfaces, with emphasis on how surface structure affects the deployment of adspecies. The formalisms that describe crystal surface energy and shape are presented and discussed in the context of understanding metal/support interactions and preferred crystal orientation. Fundamental concepts for interpreting and applying classical adsorption isoterms in the study of surface adsorption processes are elaborated upon, followed by a phenomenological treatment of adsorption and desorption kinetics that includes a description of traditional measurement methods. The authors also examine the principles and procedures commonly employed to investigate adsorbate binding energy and structure—low-energy electron diffraction and x-ray and ultraviolet photoemission spectroscopy—and tie this in to the intriguing topic of adsorbate-induced surface reconstruction.

Subsequent chapters address reactions at metal/support interfaces, electronic properties of nonmetal catalysts, and disorder in multicomponent metal oxides, followed by a discussion of the properties of metal oxides that influence specific activity and selectivity during catalysis. Much of the emphasis in this set of chapters is on binary oxides having the spinel, perovskite, and scheelite structures.

The final three chapters cover (1) grain boundary properties at surfaces, including grain boundary energetics, segregation effects, and adsorption at grain boundaries; (2) oxide layer formation at metal/gas interfaces; and (3) adsorption at metal/electrolyte interfaces. Prominent attention is paid to the kinetic aspects of oxide layer growth in gaseous environments and to the potential dependence of adsorption processes in electrolytic media.

The authors do an excellent job of weaving fundamental concepts and corresponding descriptive expressions together with illustrations from experimental measurements. Where thermodynamic principles are involved, they are presented in appreciable detail. The book is replete with informative illustrations (tables and figures) that drive home the main points of discussion. Unfortunately, some of the figures are blurred or so poorly reproduced that they are only partly legible.

One shortcoming is that the references are not more current than the early 1980s; in fact, a majority of the references are pre-1980. In a rapidly evolving field like surface science, some readers will tend to wonder how up to date the contents actually are. While some of the latest thinking from the decade of the 1980s on the relationship between materials properties and surface reactivity is surely missing from Wise and Oudar's tome, much of the information they present is based on principles and concepts that are accepted, time-tested axioms.

On the whole, *Material Concepts in Surface Reactivity and Catalysis* would be a useful addition to the personal library of any scientist or engineer with a strong interest in surface science, heterogeneous catalysis, and the solid state in general. It could also serve very nicely as a course book for an advanced undergraduate and graduate level curriculum, particularly for interdepartmental/multidisciplinary courses. Indeed, physists, chemists, and materials scientists alike would gain valuable insights about surface science and the solid state from a course of study based on Wise and Oudar's book.

Reviewer: Victor A. Maroni is a senior chemist working jointly in the Materials Science Division and the Chemical Technology Division of Argonne National Laboratory. His research interests include molecular sieve catalysis, aqueous corrosion, and the application of spectroscopic methods to the study of materials properties.

Positions Available

SENIOR RESEARCH ENGINEER

The Department of Civil Engineering of the University of Illinois at Urbana-Champaign is seeking a Senior Research Engineer for a non-tenured academic professional position to manage the laboratory facilities of the Center for Cement Composite Materials. The Center administers an interdisciplinary research program devoted to the study of advanced cement-based materials involving approximately 40 faculty and students. The Center is affiliated with the NSF Center for Advanced Cement-Based Materials. The laboratory facilities are also used by other faculty and students on campus.

Principal duties include, but are not limited to, the following: 1. coordinating maintenance and repair of a variety of computer-controlled instruments; 2. training and supervising students and research personnel; 3. maintaining records regarding facility use and billing of facility charges; 4. working with faculty and students from (other) institutions participating in the NSF Center for Advanced Cement-Based Materials (and its Industrial Affiliates); 5. advising the Director on facility needs and acquisition of new instruments; and 6. supervising advanced laboratory-oriented course work. Participation in research projects of students and faculty is possible and encouraged, as permitted by the fulfillment of the above duties.

Applicants must have at least an MS in a physical science or engineering discipline related to the study of materials. A PhD is highly desirable, but directly relevant experience may outweigh the lack of a PhD. Candidates must have at least 5 years experience involving electron microscopy, surface area and pore structure analysis, x-ray diffraction, thermal analysis, and mechanical testing. Familiarity with the science of cementitious materials is necessary. Additional experience with computer hardware and software and with electronics would be an advantage. The successful candidate should be able to communicate effectively with a variety of individuals.

Applicants should forward a resume, including names and addresses of three or more references to: Prof. Neil M. Hawkins, Head of Civil Engineering, University of Illinois, 1114a Newmark CE Laboratory, 205 N. Mathews Avenue, Urbana, Illinois 61801-2397; telephone: (217) 333-3815; FAX (217) 333-9464. This full-time position is available January 1, 1992; priority will be given to applications received by September 30, 1991. The salary range is $32,000 to $36,000.

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Duties: Responsible for operation and maintenance of university x-ray facility. Performs x-ray structure determinations and scattering experiments in collaboration with students and faculty. Instructs users on use of facility. Research will include low temperature and in situ studies of powders (phase identification and Rietveld analysis, polymers, glasses, thin films, and materials syntheses).

Position to be filled starting August 1, 1991; or open until filled.

Please send CV and references to:
Mr. Steve Carlson
Personnel Services
University of California
Santa Barbara, CA 93106-3160

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RESEARCH ASSOCIATE

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Contact: Prof. Gregory L. Griffin
Department of Chemical Engineering
Louisiana State University
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