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.

The University of Illinois at Urbana-Champaign is an Affirmative Action/Equal Opportunity Employer.

Positions Available

DEPUTY DIRECTOR
Ames Laboratory

The Ames Laboratory invites applications and nominations for the position of Deputy Director. The Ames Laboratory is a national laboratory of the Department of Energy (DOE), dedicated to research in fundamental and applied science and engineering related to the nation's current and future energy concerns, and is operated for DOE by Iowa State University (ISU). The Deputy Director has primary responsibility for new initiatives, the Office of Information, the Office of Internal Auditing, the scientific computing group, and all scientific program reviews. The Deputy Director will often represent the Laboratory at local, state and national forums and will act as Laboratory Director in the Director's absence.

The successful candidate will hold a PhD in physical science or engineering, have a scientific record commensurate with faculty status in a related academic department of ISU, have significant experience in science administration, and have a strong working knowledge of the Department of Energy.

Salary is competitive and commensurate with experience. Applications and nominations should be sent to: Dr. Tom Barton, Director, Ames Laboratory, 109 Office and Laboratory Building, Iowa State University, Ames, IA 50011.

Ames Laboratory, Iowa State University is an Equal Opportunity/Affirmative Action Employer. Minorities and women are especially encouraged to apply.

RESEARCH ASSOCIATE

Research Associate needed by solar energy research company in Golden, CO to perform molecular-beam mass-spectrometric (MBMS) studies of biomass, municipal solid waste and its components. Upgrade fast pyrolysis oil through zeolite catalyst with MBMS. Perform catalytic destruction on biomass gasifier tars using MBMS. Requires PhD, physical organic chemistry; proven ability in characterization of organic compounds using triple quarupole mass spectrometry, including specific studies in organic transients via collision-induced dissociation (CID) and ion-molecule reaction. Ability may be gained through employment or educational program. $36,000/year; 8:00am - 5:00pm, M-F. Respond by resume to Colorado Department of Labor & Employment, Division of Employment & Training, 600 Grant, Suite 900, Denver, CO 80203, ATT: James Shimada, and refer to Job Order No. C03195434.

UNIVERSITY OF CALIFORNIA AT BERKELEY
Department of Nuclear Engineering

The University of California at Berkeley, Department of Nuclear Engineering, invites applicants for a tenure-tract assistant professor position in any one of four fields: Nuclear Materials, Nuclear Thermal Hydraulics, Reactor Theory and Computation, or Fusion. Desirable areas of expertise in these fields include irradiation effects in metals, thermal science applications to reactor safety; particle transport, reactor control dynamics, and neutronics; and fusion reactor engineering and applied plasma physics, respectively. The successful candidate will be responsible for teaching undergraduate and graduate courses in the department, and must show potential for high quality research. A doctoral degree in an appropriate field is required. The position is available July 1, 1992. Interested persons should apply by **November 1, 1991** to: Dr. T. Kenneth Fowler, Chair; University of California, Berkeley; Department of Nuclear Engineering; 4153 Etcheverry Hall; Berkeley, California 94720.

The University of California is an Equal Opportunity, Affirmative Action Employer.

STAFF CRYSTALLOGRAPHER (ASSOCIATE DEVELOPMENT ENGINEER)

College of Letters and Science, University of California, Santa Barbara. PhD required in chemistry or materials science. Working knowledge of diffractometers (Scintag, Phillips Powder, Huber Single Crystal and Thin Film Diffractometers).

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

UC Santa Barbara is an Affirmative Action/Equal Opportunity employer committed to fostering diversity in its faculty, staff, and student body and welcomes applications from minorities, women and persons with disabilities.

RESEARCH ASSOCIATE

Research Associate needed by solar energy research company in Golden, CO to design, conceive, and interpret experiments in physics and formulate theories consistent with data obtained. Conduct advanced theoretical research on new and novel semiconductors in metallic alloys. Specifically, characterize and predict electronic properties of ordered and disordered superlattices systems, consisting of semiconductor and intermetallic alloys using the general Linearized Augmented Plane Wave (LAPW) method and methods of statistical mechanics. Collaborate with, and provide theoretical support to, ongoing experimental research. Prepare articles for scientific publications and disseminate novel results to the technical community by presenting papers in technical review meetings. Requires PhD, physics, 1 year experience and demonstrated ability in theoretical study of semiconductors and metals using LAPW method. Experience may be gained through educational program or employment. $32,800/year; 8:00am - 5:00pm, M-F. Respond by resume to Colorado Department of Labor & Employment, Division of Employment & Training, 600 Grant, Suite 900, Denver, CO 80203, ATT: James Shimada, and refer to Job Order No. C03195445.

RESEARCH ASSOCIATE
ELECTRON MICROSCOPY

A position is anticipated (pending final approval) at the newly established Environmental Scanning Electron Microscope facility in the Department of Chemical Engineering at Louisiana State University. The individual appointed will be responsible for operation and maintenance of the ESEM instrument, and will also have the opportunity to conduct his/her own research in any area of materials processing that emphasizes the low pressure, in-situ capabilities of the ESEM. Applicants should have an undergraduate degree in one of the physical sciences or engineering, and should have hands-on SEM experience.

Contact: Prof. Gregory L. Griffin
Department of Chemical Engineering
Louisiana State University
Baton Rouge, LA 70803

LSU is an equal opportunity employer.