BOOK REVIEWS

Selection of books for review is based on the editors' opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Title Lanthanide /Actinide Chemistry

Editor Robert F. Gould

Publishers American Chemical Society

Pages 359

Price $11.00

Reviewer Burris B. Cunningham

This volume is composed of 25 papers presented at a symposium on lanthanide-actinide chemistry held during the 152nd meeting of the American Chemical Society in September, 1966. The topics covered include optical and paramagnetic resonance spectroscopy, thermodynamics, complex ion formation, and the preparative chemistry of various solid compounds. The individual papers range in breadth of coverage from a general review of advances in lanthanide-actinide chemistry from 1960-1966, to such topics of specialized interest as the behavior of europium chelates as laser materials and the potential of the Bk^{4+}-Bk^{3+} couple.

The papers generally are of high quality, but in the opinion of the reviewer, some are exceptionally well written and informative. These include the general review paper by K. Bagnall, E. F. Westrum's survey of recent developments in the chemical thermodynamics of the lanthanides, the discussion of fluorite-related oxide phases of the rare earth and actinide elements by L. Eyring, the theoretical treatment of lanthanide and actinide solution spectra by W. T. Carnall and P. R. Fields, and M. Fred's discussion of the electronic structure of the actinide elements.

Several of the less-general papers are of particular interest as representing important new advances in our knowledge of the chemistry of the $4f$ and $5f$ transition elements. These include the discussion of the kinetics of aqueous oxidation-reduction reactions of U_1, Np, Pu, and Am by R. W. Newton and F. D. Baker, the paper by N. Edelstein, W. Easley, and R. McLaughlin on the optical and paramagnetic resonance spectra of actinide ions in single crystals, the electronic spectra of lanthanide compounds in the vapor phase by D. M. Gruen, C. W. DeKock, and R. L. McBeth, and the contribution by R. Penneman, T. Keenan, and L. Asprey on actinide fluoride complexes.

On the whole, *Lanthanide/Actinide Chemistry* represents a very valuable contribution to the literature in this field of chemistry. The book should be of interest not only to the specialist but to any chemist wishing to acquire a broad perspective of current knowledge about this fascinating group of elements.

Burris B. Cunningham (PhD, University of California, 1940) is Professor of Chemistry at the University of California and a member of the Senior Staff of Lawrence Radiation Laboratory. His work on the chemistry of lanthanide and actinide elements has earned him an international reputation.

Title Molecular Processes on Solid Surfaces

Editors E. Drauglis, R. D. Gretz, and R. L. Jaffe

Publishers McGraw-Hill Book Company

Pages xvii + 651

Price $37.50

Reviewer Donald E. O'Reilly

The physics and chemistry of solid surfaces have advanced admirably in the last decade from both experimental and theoretical techniques applied to the field. The book represents the proceedings of the third Battelle Memorial Institute Materials Science Colloquium held in Kronberg, Germany in May, 1968. The book consists of four introductory lectures by J. H. de Boer, C. Wagner, H. E. Farnsworth, and T. Jansen and 24 research papers under headings of (1) characterization and structure, (2) electronic interactions, (3) adsorption, (4) nucleation and growth, and (5) microscopic effects. Also included are agenda discussions of each topical heading and a prefatory autobiographical sketch honoring the contributions of Professor I. N. Stranski to our knowledge of the structure of surfaces.

The introductory lecture by de Boer outlines views on the mobility of molecules on solid surfaces similar to those in his well-known book *The Dynamical Character of Adsorption.* Carl Wagner's lecture covers by now classical methods for investigating the mechanisms of catalytic hydrogen and oxygen transfer reactions. The article by Farnsworth and Onchi deals with the significance of intensity vs voltage curves in the interpretation of low-energy electron diffraction results on surfaces. Applications to the interaction of N_2O and NO with the 100 planes of nickel metal are surveyed using the complementary techniques of mass spectroscopy. The lecture by Jansen describes the not-so-novel idea of the phenomena of superexchange applied to the elementary chemisorption process of small molecules on metals. Elementary calculations are carried out for a three-center problem which involves two centers with initially unpaired electrons. Application is made to the Pt-H_2 system, NiO, and the xenon fluorides. The introductory lectures serve their purpose well to review some of the well-known concepts of surface science and to stimulate the reader into reading the remainder of the book.

In the research papers the experimental techniques of field-emission microscopy (FEM), field-ion microscopy (FIM), ellipsometry, low-energy electron diffraction (LEED), field-effect and surface-photovoltage, and Auger electron analysis are rather completely discussed. The article by Müller on advances in FIM is beautifully illustrated with photographs of metal tips in the microscope. In this article the new atom-probe field-ion microscope is briefly discussed. A rather complete study of oxygen adsorption on clean CdS surfaces is presented by Many et al. with the use of the techniques of field-effect and surface-photovoltage measurements. Such chemisorption processes should exhibit interesting magnetic properties such as electron paramagnetic resonance of O^- or O_2^- species produced upon chemisorption.

Theoretical techniques include standard perturbation theory procedures (Jansen and Grimley), density matrix and random phase approximation methods (Gerlach), and scattering theory (Drauglis). The theoretical calculations seem to have been based for the most part, however, upon rather drastic assumptions such as the average energy denominator approximation of second-order perturbation theory. The published discussions following each lecture are spirited and informative. Especially well done is the concluding discussion with G. D. Halsey as chairman. The discussion by Zemel on the "bird-worm" characterization of surface science investigators is facetious but quite true. As noted in this discussion, unfortunately little attention was paid to magnetism, particularly to the techniques of nuclear and electronic magnetic resonance which seem to be capable of revealing new facts about the nature of surfaces and the gas-solid interface.

Donald E. O'Reilly (BS, Purdue; PhD, University of Chicago, 1955) is an associate chemist in the Solid State Science Division at Argonne National Laboratory. His research activities include the study of ferroelectric phase transitions in solids, liquid state physics, and surface phenomena using the techniques of nuclear and electronic magnetic resonance.

Title Statistical Models in Engineering

Authors Gerald J. Hahn and Samuel S. Shapiro

Publishers John Wiley & Sons, Inc. 1967

Pages 355 + index

Price $12.50

Reviewer Neil Cox

The purpose of the authors in writing this book, as stated in the Preface, was to show the engineer responsible for a product whose performance is subject to chance fluctuations just how to choose a reasonable statistical model and how to use this model in the solution of practical problems. Thus, their main concern was the use and manipulation of statistical models for representing engineering phenomena. In this task, the authors succeeded very well. The book is well written and contains no glaring typographical errors. It can be read by anyone with the minimum undergraduate engineering mathematics.

The authors state that no previous training in statistics is required; and in Chap. 2 they provide a review of the basic concepts of probability and distributional models. This reviewer can state that Chap. 2 makes for interesting and informative reading, even for those with a prior knowledge of statistical methods. Chapters 3 and 4 deal with distributions, continuous and discrete, respectively. Of the distributions used as engineering models, 11 continuous functions and 7 discrete functions are described, along with a summary of their applications. These two chapters alone are worth the price of the book.

Chapters 5 and 7 deal with the problem of describing the behavior of a system from knowledge of the system structure and the behavior of its components. Clearly this is a problem of paramount importance to the practicing engineer, and this book provides an understandable source for the necessary techniques. In Chap. 5, the exact method known as transformation of the variables is presented. Chapter 7 deals with the method of generation of system moments and the Monte Carlo simulation method.

In Chap. 6, there are discussed methods for fitting distributions to data in situations where the underlying physical phenomena are not well understood. One might wonder why this material was injected between the closely related Chaps. 5 and 7; however, this does not seriously detract from the continuity. Chapter 8, the final chapter, deals with methods of evaluating the adequacy of a chosen model by both graphical and analytical procedures.

In summary, this is a well written volume which contains much practical information in one compact place. I have found it useful in my own work, and, without reservation, I recommend it to the practicing engineer.

Neil Cox earned his BS in chemical engineering at the University of Texas and advanced degrees at the University of Wisconsin. In 1962, he joined the Department of Chemical Engineering of the University of Arizona where he teaches an undergraduate course on statistical methods and a senior-graduate course on experimental design. In 1965, as a participant in the Ford Foundation's Engineering Residency Program, he spent a year in industrial process development with duPont.