

Treatise on Materials Science and Technology, Vol. 19, **Experimental Methods**, part B, ed. by H. Herman, Academic Press, New York, 1983, 274 pp. \$45.00

REVIEWED BY A. J. McEVILY¹

Volume 19b of this ongoing series contains five articles on some esoteric topics within the general field of experimental research. The first article, Exoelectron Emission, is by W. J. Baxter of the General Motors Research Laboratories. The term exoelectron emission refers to the process of electron emission from the surfaces of metals, semiconductors, and insulators as the result of abrasion, plastic deformation, fatigue cycling, optical radiation, or by various forms of ionizing radiation. The article covers instrumentation, mechanisms of emission, and applications to the fracture of oxide films, plastic deformation and fatigue.

The second article is on Photoacoustics in Materials Science by Allan Rosencwaig formerly with the Lawrence Livermore Laboratory. Photoacoustic spectroscopy is the study of energy absorbed from an incident beam of optical photons by a material owing to its interaction with the photon beam. Photoacoustics measures the internal heating of the sample as determined by sensitive piezoelectric detectors in contact with the specimen (temperature changes of 10^{-7} - 10^{-6} C can be detected). Applications of the method include the determination of optical absorption of highly light scattering materials and material opaque to transmitted light. A unique characteristic is the capability of performing nondestructive depth-profile analysis of absorption as a function of depth into a material. It may be used in the study of fluorescence and photochemistry in matter.

The third article is on Microdynamic Testing of Materials by E. M. Uygun of the ME Dept. of the Middle East Technical University of Ankara, Turkey. It deals with the experimental aspects of microdynamics damping phenomena and their relation to various submicroscopic and microscopic material properties and processes. The measurement techniques and applications to the study of Snoek phenomena, Zener phenomena, phase transformations, dislocations, grain boundaries, recrystallization, creep and fatigue are discussed.

The fourth article is on Experimental Methods in the Mechanochemistry of Inorganic Solids by Vladimir Boldyrev formerly then of the Siberian Branch of the Academy of Sciences of the USSR in Novosibirsk. The topic deals with the influence of mechanical processing on the rate of heterogeneous processes. Increases in reaction rates can occur as the result of the creation of new surfaces together with defects and to the appearance of active reaction centers on new surfaces. The article deals with methods of investigation

and the variation in properties such as excess energy, crystal and surface sizes, defects, and the charge on cleavage planes caused by mechanical pretreatment. Applications to actual processing situations aside from the obvious such as the creation of new surfaces is lacking.

The final article deals with High-Resolution Transmission Electron Microscopy and is by Ronald Gronsky of the Lawrence Berkeley Laboratory. It provides a review of the principles, systems and techniques involved in this field.

In general the articles are well prepared and provide a good introduction to the various topics. A comprehensive index adds to the value of the volume. The book should be of interest to researchers desirous of learning more about the topics discussed.

Coatings for High Temperature Applications, E. Lang, Ed. Applied Science Publishers, Ltd., Barking, Essex, England, and Elsevier Publishing Co., Inc., New York, 1983, 422 pp., Price. \$89.

REVIEWED BY J. L. LAUER¹

This volume contains a collection of papers presented at a seminar on "Coatings for High Temperature Applications" organized by the "Information Centre" Project, Joint Research Centre, Petten Establishment, The Netherlands, in 1982. The motivation for high-temperature coating development has come primarily from aircraft gas turbine components, where the demand for increase in alloy strength resulted in alloy composition changes that decreased corrosion resistance. The two major coating systems developed for improved corrosion resistance are aluminization of the substrate component and vapor phase deposition to form an overlay coating layer. Even more difficult situations apply in other technologies, such as tubing materials in coal conversion processes, where both chemical attack by carbon, sulfur, and oxygen-bearing gases and severe particulate erosion play roles.

The twelve articles are grouped in four sections, Fundamental Aspects, Coating Technologies, Evaluation of Coatings and High Temperature Applications of Coatings. The titles of the articles are (1) Oxidation-Corrosion-Erosion Mechanisms of Environmental Degradation of High Temperature Materials (by Pettit and Goward), (2) Protective Coatings for High Temperature Materials: Chemical Vapor Deposition and Pack Cementation Processes (by Duret and Pichoir), (3) Evaporation and Sputter Techniques (by Teer), (4) Spray and Detonation Gun Technologies, Laser-assisted

¹Metallurgy Department, University of Connecticut, Storrs, Conn.

¹Rensselaer Polytechnic Institute, Troy, NY 12181

Techniques (by Steffens), (5) Bulk Coatings for Use as Elevated Temperatures (by Bucklow), (6) Applications and Evaluation of Ceramic Coatings Produced by Sol-gel Technology and Vapor Deposition Procedures (by Bennett), (7) Testing and Inspection of Coatings (by Steffens, Crostack and Beczkowiak), (8) Techniques for Structural Analysis of Deposited Materials: Correlation of Film Structure and Properties (by Jacobsen), (9) A Survey of Methods used for the Performance Evaluation of High Temperature Coatings (by Nicoll), (10) Gas Turbine Applications (by Pettit), (11) Coating of Diesel Engine Components (by Kvernes) and (12) Surface Treatments for Tribology Problems (by Childs). With the exception of Pettit, Goward, and McGuire, who work in the U.S.A., all the authors work in Europe.

The articles are generally very readable by engineers who are not specialists in coating technology. Sufficient detail is provided to permit an appreciation of the advantages and disadvantages of the various technologies. The list of references at the end of the chapters would seem to be adequate and recent, though certainly not complete; for example, Hinterman's very considerable contributions to vapor phase deposition techniques applied to bearings, especially titanium nitrides and carbides, are not listed.

This book is a very fine introduction to an important new technology.

Isostatic Pressing Technology, P. J. James, Ed. Applied Science Publishers Ltd, Barking, Essex, England and Elsevier Science Publishing Co., Inc., New York, 1983, pp. 259. Price \$48.

REVIEWED BY J. L. LAUER¹

This book contains papers on the technologies and applications associated with both cold and hot isostatic pressing, which were presented at the First International Conference on Isostatic Pressing at Loughborough University of Technology.

The term "isostatic pressing" refers to "the state of submission to equal pressures from all directions." This state is brought about by submersion of a powder in a pressurized fluid. Thus the basic principle of isostatic pressing (IP) is Pascal's law. Cold isostatic pressing (CIP), carried out at ambient temperature, generally serves only as the first compacting step, which produces a product in the "green state." Subsequent sintering of the green product and other steps are required to yield the final product. These steps are combined in "hot isostatic pressing" (HIP). HIP is also applicable to the removal of internal defects.

Although the ideas underlying CIP and HIP are simple, the practical problems encountered in producing typical IP products such as refractory bricks for the lining of furnaces, alumina grinding wheels, (alumina) spark plug insulators, silicon nitride tubes and bearings, crucibles, and wear-

resistant tools of high-speed steel are considerable. The main difficulties are cracks and dimensional changes. However, once these difficulties were solved for a particular product, duplicates can be produced in large numbers and very cheaply.

Engineers about to start working on an IP process, or already working on one, might find ideas in this collection of articles by experts. As an introduction to IP it suffers from a lack of continuity. The introductory article by P. J. James, "Principles of Isostatic Pressing," is supposed to form the bridge between the articles, but it did not quite achieve this goal. For example, it uses the term "green strength," but does not explain what is meant by "green." The other articles take an understanding of this and other concepts for granted. They are concerned with safety and with specific equipment and applications of CIP and HIP.

Surface Coatings, Volume I: Raw Materials and Their Usage, By the Oil & Colour Chemists' Association of Australia, Chapman and Hall Ltd, London and New York, 1983, 408 pp., Price: \$56.

REVIEWED BY J. L. LAUER¹

This encyclopedia was prepared by the Oil and Colour Chemist's Association of Australia, who did a remarkable job creating uniformity out of parts written by individual authors. It is perhaps not generally known that house painting came after artistic painting; Greek and Roman artists, for example, brought the pigments to the Western World. Only in the nineteenth century was the value of coatings to protect property recognized and the once secret formulations became the products of factories.

After a historical introduction this volume contains such chapters as "Introduction of Polymer Science," "Vegetable Oils," "Oleoresinous Media," "Alkyd Resin Technology," "Polyesters," "Silicone Resins," "Polyurethane Resins," "Emulsion Polymerization (several chapters in some detail)," "Pigments." In all instances the chemistry and the engineering aspects of manufacture as well as the pertinent physical and chemical properties of typical products are listed and commented on. Enough of the organic chemistry of each class of material is presented to provide the reader with a fair understanding of their behavior. There is a wealth of tables and diagrams. The presentation is very much user-oriented. For example, in the chapter on water-soluble polymers a table listing the characteristics of some of them is given together with their advantages and disadvantages.

Both novices and old hands in the field will benefit from this book.

¹ Rensselaer Polytechnic Institute, Troy, NY 12181.

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