

pulse amplifiers, discriminators, and logarithmic count rate meters. Chapter 4 covers reactor safety systems, reliability, fail-safe principles, spurious shutdowns, typical redundant systems, and static switching. The measurement of neutron flux within the reactor is presented in Chapter 5 with general activation methods, gamma emitters, wire irradiation, beta emission, coolant activation, boron thermocouples, fission heating detectors, current ionization chambers, boron counters, and fission counters. The problem of fuel failure detection is discussed in Chapter 6: gamma ray emission, delayed neutrons, fission products, electrostatic precipitator detector, gas sampling, and analog and digital recording. Chapter 7 deals with reactor plant instrumentation in general and discusses: force balance transducers, pneumatic systems, electrical transducers, flow measurements, pressure rate measurements, CO₂ moisture content, and CO₂ content in steam. The last chapter reviews health physics instrumentation, sources of radioactivity, radiation measurements, portable monitors, and gaseous and liquid coolant activity.

All of the above material is presented in 66 pages. Therefore the reader should not expect any more than to be familiarized with reactor instrumentation.

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(About the Reviewer: W. C. Lipinski is currently Head of the Reactor Control and Instrumentation Section, Reactor Engineering Division, Argonne National Laboratory, where he has been engaged in reactor control and instrumentation since August, 1950. He was responsible for the instrumentation for the BORAX experiments and subsequently for the instrumentation and control design of EDWR. He has since been directly involved in instrumentation of CP-5, ALPR, JUGGERNAUT, and High Flux Critical Assembly. He is coauthor of the Control and Instrumentation chapter of the revised AEC Reactor Handbook.)

Chemical Processing of Reactor Fuels. Edited by JOHN F. FLAGG. Academic Press, New York, 1961. 530 pp. \$17.50.

This multiauthored book provides a valuable treatment of chemical technology in the nuclear industry. In its exposition of solvent extraction and related aqueous-reprocessing techniques, on which the book is centered, it stands between the briefer treatment of Benedict and Pigford's "Nuclear Chemical Engineering" and the more detailed and specialized papers in Bruce, Fletcher, and Hyman's "Process Chemistry" series or in the proceedings of the 1955 and 1958 Geneva Conferences. By its inclusion of key chapters on mathematical treatment and on equipment, the book has a distinct engineering flavor. It is almost encyclopedic in character, giving about 500 references to key literature. Its organization, between and within chapters, is logical and convenient; the type of treatment and presentation adopted has led to a most readable and usable text.

An international team of experts has accomplished a job that could not so readily have been done by any one person—with the result that even an expert in any one of the areas treated will be likely to fortify his knowledge and understanding of adjacent fields, and his capacity to make new contributions, through use of this book. The separate

topics treated are recovery of U and Th from their ores (Svenke, Gelin, and Welin); disassembly and dissolution of fuels (Stansky); principles of extraction (Haas); tributyl phosphate extraction (Siddall); hexone extraction (Flagg); equipment for extraction (Davis and Jennings); precipitation, ion exchange, and further extraction methods (Wells and Pepper); criticality (Nicholls, Woodcock, and Gillieson); and effluent processing (Saddington).

The chapter on general principles of solvent extraction gives mathematical relations for cocurrent and counter-current multistage contacting, the latter with both constant and nonconstant extraction factor, in simple and also center-fed systems. McCabe-Thiele diagrams (extract vs. raffinate concentration) are used effectively to show the types of solute profiles in a column. These figures are mostly qualitative, but a small plot of uranium-TBP distribution data is included in connection with concentration profiles for a 20-stage Purex system under a specified material balance. Ideally, detailed sample calculations should have been included around a representative equilibrium stage, and methods of correlating equilibrium data might also have been discussed. However, a brief introduction to nonequilibrium mass-transfer theory is included, which may prove helpful for nonengineers.

In the chapter on tributyl-phosphate extraction processes, a welcome feature is the section on "future development" which includes a review of related extractants and also a brief intercomparison of "wet" and "dry" processing. For the equipment chapter, excellent drawings and photographs supplement a discussion that is both descriptive and analytical. A section on the processing of a homogeneous aqueous reactor provides a detailed example of the handling of "hot" solutions. The chapter on criticality reviews the elementary principles of fission reactions, and applies them extensively to the problem of accidental, uncontrolled, unwanted criticality such as might occur in a processing plant.

The entire treatment is of high quality, and the book is recommended by this reviewer. It should serve as a handbook and bibliography for persons engaged actively in this field; as an introduction to the field for chemical engineers just entering it; and as a guide for nuclear chemists and nuclear engineers in general who may be concerned with fuel preparation and reuse.

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(About the Reviewer: Theodore Vermeulen, Professor of Chemical Engineering at Berkeley, is also a research engineer in the Lawrence Radiation Laboratory. During 1948-52 he headed a developmental study of fuel reprocessing by the T.T.A. process. More recently he has carried on investigations of ion exchange and adsorption, liquid-liquid agitation, axial dispersion in packed extraction columns, and mass-transfer behavior at interfaces.)

Rare Earth Research. Collected papers presented at the Lake Arrowhead (California) Research Conference on Rare Earths in October 1960. Edited by EUGENE V. KLEBER. vi + 313 pp. Macmillan, New York, 1961. \$9.75.

On the wooded shores of lovely Lake Arrowhead—in the mountains of Southern California of course—a truly re-

markable conference was held in October 1960 on the current research being done in many places on the rare earths (including now scandium and yttrium). The present book, with a table of contents but no index, contains, in full, the some thirty papers presented at the conference, and none of them are at all superficial; some are better than others, but all are substantial and have a scholarly tone. The subjects covered are far flung and range from solution chemistry and oxide systems to the structure and physical properties of the now easily obtainable pure rare earth metals and their alloys.

All of the known chemical and physical principles and techniques were brought to bear on the problems attacked by the investigators and their aides. One can't help but be impressed by the wealth of information obtained. It is impossible, in a short review, to cover in any detail the ground covered in the many researches described, or to name the more than fifty authors responsible for them.

The papers originated in various laboratories of universities, industry, and the federal government; and the authors are all, scientifically speaking, mighty fast guns. But some, naturally, are faster than others.

It is evident from the book that the rare earth metals and their compounds, which only thirty years ago were of interest mainly to pure scientists, have more and more moved into the realm of engineering. Their applications now range from aircraft and submarines, to special glasses and transistors. In no time at all one may confidently expect to find that all men west of Dodge City are carrying pistols made from thulium, and that each lady will be wearing a gadolinium dagger on her person. Strangely enough a goodly number of the recent great advances in rare earth chemistry, physics, and metallurgy have been made at a little known university located in the quite obscure state of Iowa (sly dig at Ames).

Although the book will be a *must* for rare earth chemists and physicists, and will prove of interest to the nonspecialist as well, it needs to be emphasized that supplementary sources will be required in order to discover what EDTA and other alphabetical jargon really mean in English. In the splendid papers on the mechanical properties of the pure rare earth metals and their alloys there is no description of the appearance of the metals nor any hint as to whether or not they can be filed, drilled, or turned in a lathe effectively. If a wayfarer in Ciudad Bolivar, Topolo-

bampo, or Ames were to stumble onto a bar of pure dysprosium, the book wouldn't help him much to identify the treasure he had in his grasp. Artistic souls may well be dismayed by the dust jacket. The highly fundamental evening paper presented by Dr. Charles D. Coryell is not, unfortunately, to be found in the book (hic deplorate).

The Arrowhead conference was remarkable for more reasons than one. In spite of the strong temptations to go boating, fishing, hiking, or duck hunting, every session was more than well attended. There was little or no politicking in the corridors. At the evening cocktail hours the bracing mountain air seemed to prevent anyone from becoming visibly tipsy, even though California tequilatinis are alleged to be capable of quickly dissolving olives and toothpicks. As an additional blessing, there were apparently no academic, industrial, military, or governmental high brass present at the conference; only highly competent working chemists, physicists, and engineers were in evidence. The whole atmosphere was, therefore, relaxed and inspiring.

To the present day humanist the book may seem incredibly dull. All of the characters are above reproach and are reporting on their many, many intricate and difficult researches on a small group of strange and fascinating elements. Here one finds no villains, no deviates, no trulls, trollops or shills, but only the pure in heart. In a word, there isn't a speck of sin in the whole book; and yet it describes the constructive activities, and minor controversies, of very human gentlemen (hic plaudite).

DON M. YOST

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(About the Reviewer: Professor Don M. Yost of the Chemistry Department of California Institute of Technology was recommended to us as a reviewer by Charles Coryell who described him as "an old hand at rare earths and a reviewer noted for colorful prose along with high relevance." We note in addition that he was one of the conference chairmen and since he was there apparently does not consider himself of "high brass in academic, industrial, military, or governmental circles." We are sure he qualifies as one of the group of "highly competent working chemists, physicists, or engineers." We add editorially that we suspect he packs a pistol and is not one to be fooled around with.)