Book Reviews

High Magnetic Fields. Proceedings of the International Conference on High Magnetic Fields, held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, November 1–4, 1961. Sponsored by the Solid State Sciences Division of the Air Force Office of Scientific Research. Edited by HENRY KOLM, BENJAMIN LAX, FRANCIS BITTER, AND ROBERT MILLS. M.I.T. Press, Massachusetts Institute of Technology, and Wiley, New York, London. 751 pp., 419 figures. $15.00.

The editors of these proceedings are well known experts in the production and the use of high magnetic fields: Henry H. Kolm did outstanding work in the development of pulsed-field and powerful continuous-field magnets. Benjamin Lax is well known for his important research work in solid-state. He is director of the National Magnet Laboratory at MIT and head of the solid-state division of Lincoln Laboratory. Francis Bitter, professor at MIT, is an authority in magnetics and did pioneer work in designing high field water cooled magnets ("Bitter Magnets"). Robert G. Mills, in his capacity as division head of the Plasma Physics Laboratory at Princeton University, contributed greatly to the development of research machines for thermonuclear studies.

The International Conference on High Magnetic Fields had an attendance of nearly nine hundred participants including persons of eleven foreign countries. Not less than 86 papers were presented. In this volume, these papers are arranged as logically as possible in four parts devoted, respectively, to (1) the generation of high fields, (2) high-field research programs at a number of centers throughout the world, dealing with both the generation and the use of high fields, (3) high magnetic fields in solid-state and low temperature physics, and (4) the use of high fields in plasma physics.

The papers presented are in general on a high scientific level. Unfortunately, available space permits listing only a few outstanding lectures of each of the mentioned four groups. F. Bitter talked on water-cooled magnets, D. B. Montgomery on iron magnet design, and H. P. Furth on pulsed magnets. A series of lectures concerned high-magnet field research programs of several well known laboratories (for instance, the Clarendon Laboratory in Oxford and the Cavendish Laboratory in Cambridge, England, the Kamerlingh Onnes Laboratory in Leiden, Holland, the National Magnet Laboratory at the MIT in Cambridge, Mass.). B. Lax presented a paper on magnetospectroscopy in solids, and Nicholas Kürti discussed the use of high magnetic fields in low temperature physics. Actual problems in superconductivity were covered by 15 papers concerning superconducting materials and superconducting magnets (J. E. Kunzler, S. H. Autler, and others). Finally, applications of high magnetic fields in plasma, fusion, and particle physics were well represented by experts like B. Lehnert (Stockholm), R. G. Mills (Princeton, N. J.), F. H. Coensgen (Livermore, California), and several others.

Three sessions of the conference were devoted to *biomagnetics*; however, these lectures were not included in this volume since it was felt that these papers would be more appropriate in the pertinent journals.

The proceedings of the International Conference on High Magnetic Fields give an excellent picture on the actual state of this extensive field of research and development and includes complete lists of references on previous work. This volume is at this time the best reference book available.

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(About the Reviewer: Wilhelm F. Gauster was educated at the University of Technology in Vienna where he served later as professor of electrical engineering. He came to North Carolina State College in the same capacity in 1950. Since 1957 he has been at Oak Ridge National Laboratory where he heads the engineering sciences group of the Thermonuclear Division.)

NS 323, 0 Tables, 0 Figures

Nuclear Reactor Instrumentation. By M. W. JERVIS. Temple Press, London. 74 pp., 24 figures, $2.95. Distributed in U.S.A. by Simmons-Boardman, New York.

M. W. Jervis is Senior Engineer, Electrical Department, The Nuclear Power Group.

This monograph is intended for university and technical college students, research assistants, and qualified technicians who require a broad understanding of those topics of nuclear engineering outside their own field of study.

The author covers all aspects of instrumentation of a nuclear power plant. The references and illustrations are for a gas cooled power reactor, but this in no way detracts from the value of the monograph. The material as presented will give the reader an excellent picture of what is required in instrumenting nuclear power plants in general. The typical numerical values used by the author serve to further increase the value of this monograph by giving the reader concrete information which is more than just descriptive.

In the first chapter the cost of instrumentation and elementary reactor kinetics are discussed. Chapter 2 covers reactor temperature instrumentation, thermocouples, potentiometer recorder-indicators, automatic data loggers, and high temperature safety amplifiers. Chapter 3 discusses methods to measure reactor power by nuclear measurements outside of the reactor core, neutron sources, neutron sensitive ionization chambers, gamma compensation, fission chambers, boron trifluoride counters, boron lined counters, fission counters, scintillation counters, linear current amplifiers, logarithmic current amplifiers, period meters,

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, CO_2 moisture content, and CO_2 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 countercurrent 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-