

**Biotechnology and Energy Use
(Electrotechnology Series, Vol. 8)**

<i>Authors</i>	Robert J. Clerman, Rajani Joglekar, Robert P. Ouellette, Paul N. Cheremisinoff
<i>Publisher</i>	Butterworths, Woburn, Massachusetts (1981)
<i>Pages</i>	189
<i>Price</i>	\$39.95
<i>Reviewer</i>	Massoud T. Simnad

The authors define the objective of this book to be an evaluation of the potential impact of bioindustry on industrial energy use. More than 60 biotechnology applications involving advanced uses of fermentation and enzyme technology (e.g., food, energy, and waste treatment) are reviewed. These studies were sponsored by Electricité de France and were carried out at the Metrek Division of the Mitre Corporation and the New Jersey Institute of Technology. The recent developments in this field are considered to be "revolutionary," with the most far reaching aspect being recombinant DNA technology or "genetic engineering." For example, microbial production and development of immobilized enzymes for industrial enzymes are expected to total approximately \$500 million by 1985. An objective of the studies that are reported is to identify those applications that have near-term commercialization and that are likely to affect energy consumption patterns. This book presents a concise review of the principal tools of biotechnology, surveys the key industrial sectors, and gives brief descriptions of individual applications. These include food production, energy, waste treatment, chemicals, and metals recovery.

The first chapter provides an overview of biotechnology applications. The principal tools of biotechnology are described in terms of the several component techniques that apply across a wide range of applications, i.e., whole cell fermentation, enzyme technology, and genetic engineering. The key industrial sectors that are studied are then surveyed and the status of bioindustry is assessed. Biotechnology is considered to be a highly dynamic field, particularly because the use of microbial systems can reduce the energy consumption due to lower operating temperatures and pressures. However, the technical hurdles to be overcome are also discussed. These include the difficulty in conversion from batch to continuous processing; sensitivity to variations in temperature, pH, nutrient, etc.; susceptibility to viral infection or contamination with toxins; and quality and quantity control. The applications of special interest to energy and nuclear power include cellulose waste treatment to produce alcohol (pilot/commercial); methane production utilizing cow manure by direct anaerobic digester operation (full-scale operation); production of liquid hydrocarbons from algae (pilot scale); production of ethanol from starch (commercial); production of uranium by extraction of bacterial leaching (commercial); and uranium mining site restoration and waste water treatment by bacterial leaching (pilot plant).

The bacterial restoration of *in situ* uranium mine operations, leached with ammonium carbonate solutions, has received much attention. The bacteria "Nitrosomonas" oxidize ammonium to nitrite, and the bacteria "Nitrobacter"

oxidize nitrite to nitrate. Other denitrifying bacteria will reduce nitrate to nitrous oxide or ammonium ion. Bacterial restoration of mining and milling waters has been accomplished successfully at several mining ventures by using algae and higher aquatic plants that accumulate or entrap heavy metals.

Uranium extraction by bacterial leaching consists of the solubilization of the uranium from their ores by mineral sulfide oxidation and release of the metals. In hydrometallurgical processes, bacterial leaching is an important emerging technique for the extraction of metals. This type of *in situ* mining by bacterial leaching is said to be an attractive option due to the reduced environmental impact over conventional mining, the feasibility of extraction from deeper deposits, and the favorable economics of mining low-grade mineral resources. Nevertheless, the commercial production of uranium by this process in Canada (Agnew Lake Mine Ltd.) was discontinued in 1981.

This Monograph is a very well written and objective source of information on the important topic of biotechnology.

Adjunct professor of materials science and technology and nuclear energy at the University of California, San Diego, Massoud T. Simnad obtained his PhD at Cambridge University. He has held senior positions at GA Technologies and served as a visiting professor at Massachusetts Institute of Technology.

He has authored or coauthored over 90 papers and 14 patents on nuclear fuels and materials.

**Superconductor Materials Science (Metallurgy,
Fabrication and Applications) Series B: Physics**

<i>Editors</i>	Simon Foner and Brian B. Schwartz
<i>Publisher</i>	Plenum Publishing Corporation, New York (1981)
<i>Pages</i>	969
<i>Price</i>	\$85.00
<i>Reviewer</i>	Massoud T. Simnad

This large volume is based on the NATO Advanced Study Institute Conference, which was held August 20-30, 1980, in Sintra, Portugal. The focus of the lectures involved the science and applications of superconductors, concentrating primarily on the materials aspects. The first part of the book reviews the basic principles, properties, and fabrication technology of the practical superconducting materials. The following parts include descriptions of phase diagrams and mechanical properties of superconductors. Novel new techniques of fabrication of materials, such as *in situ* and powder metallurgy techniques, are reviewed. The practical fabrication technology receives extensive coverage. Amorphous materials and materials development for small-scale devices, such as Josephson junctions and SQUID devices, are also discussed.

Large-scale applications of superconductivity are described in some detail. Superconducting magnets appear to

be of vital importance to fusion and magnetohydrodynamic power equipment, to magnetically levitated railroad vehicles, and are being considered for energy storage in a range of applications. The superconducting Josephson junction has "secured an important niche in the electronic hierarchy of advanced computer systems." Also, "the big science of high energy physics has made extensive use of superconducting magnets."

The ability of superconductors to operate at very high current densities offers the prospect of magnets with very compact lightweight windings able to produce high fields and high-field gradients. The problem of instability and the various techniques for stabilization have exerted the most influence on practical superconductor design. Also, protective techniques are required to ensure safe quenching of superconducting magnets.

The editors point out that materials development and performance in operating systems are the basis of the continued applications and economic viability of superconducting technology. A complete review of all materials technology is presented by leading authorities who were instrumental in the development of superconducting materials technology, which has mushroomed in the past decade. Technologies in this field, which were discussed only in the early 1970s, are now well beyond the prototype stage.

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Nuclear Power Hazard Control Policy

Author John C. Chicken
Publisher Pergamon Press, Inc.
 Elmsford, New York (1982)
Pages 280
Price \$15.00
Reviewer Gerald A. Schlapper

This book presents an analysis of factors that seem to have influenced the formation and organization of control of nuclear power in Great Britain. The presentation begins with a discussion of the technical nature of the hazards and of the legal and administrative framework that exists for control of these hazards. Following this introductory material, the main body of the publication addresses the influence exerted on the "hazard control" efforts by social and political factors.

Special emphasis is placed on those political groups that have developed interest in the problems of nuclear power. The author traces the history of these groups from their formation, some during the World War II time frame, to the events at Windscale. The analysis of policymaking and im-

plementation includes discussion of the manner in which power and authority are exercised in society to influence decisions on technical matters. The author addresses the evolution of policy in a changing atmosphere of economics and conflicting ideas of morality. A model of a policymaking system that accounts for changes in the technical, social, and political environment is proposed.

While the text is primarily oriented toward developments in Great Britain, numerous parallels are made with events in the United States. This study is well referenced with over 750 specific references in the text and a bibliography of over 80 books, 30 reports, and a list of over 110 newspaper and journal articles. Reading of the text is somewhat difficult due to the small-sized type that was employed, I assume, to keep the size of this volume tractable. There is much more information contained in this publication than the number of pages indicates.

This book is not a publication for light reading and is recommended for senior level managers, regulators, educators, and others of a similar level. It is useful as a reference for individuals interested in the interplay of factors that control the formation and development of regulation of the nuclear industry not only in Great Britain but also in the United States.

After receiving his MS in nuclear engineering from the University of Missouri at Columbia in 1970, Gerald Schlapper joined the reactor operations staff of the University of Missouri Research Reactor Facility. Dr. Schlapper received his PhD in 1977 and remained on the staff of the Research Reactor Facility until January 1981, when he assumed his current position as a faculty member of the nuclear engineering department at Texas A&M University. During his career, he has served as a consultant to various government and private organizations.

Heat Exchangers—Theory and Practice

Authors J. Taborek, G. F. Hewitt, and N. Afgan
Publisher Hemisphere Publishing Corporation,
 New York (1983)
Pages 992
Price \$69.95
Reviewer Warren M. Rohsenow

This book is a collection of papers presented at the 1981 Seminar of the International Centre for Heat and Mass Transfer in Yugoslavia. The papers were selected to cover a large spectrum of heat exchanger applications.

The first 18 papers cover evaporation and condensation. The initial paper is a survey of problems in condensation and boiling. In flow boiling the Steiner paper neglects the forced convection contribution, and his proposed correlation departs from data by as much as 400%. Bonn presents detailed results for the effect on nonuniform peripheral heat flux on flow boiling, and three papers present results for boiling on enhanced surfaces in tube bundles. Bonn also presents critical heat flux (CHF) data for flow boiling of nitrogen and argon