

ences make it a good starting point in addressing almost any area of biotechnology. The field of biotechnology is a moving target. While you might not hit a "bull's eye" on a topic, the large scope almost ensures hitting the target.

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#### **Volume 4—The Practice of Biotechnology: Specialty Products and Service Activities**

Edited by Campbell W. Robinson and John A. Howell, 1165 pp.

This volume essentially consists of three large sections written by an international group of well-known specialists. The first section consists of a diversity of technical papers on applications areas in biotechnology ranging from biomedical, chemotherapeutic, agriculture biopulping, enhanced oil recovery to mineral processing. The second section focuses on contributions from U.S., Canadian, Japanese and European specialists on government regulations on biotechnology and topics include patents, biohazards, and new drug regulation. The third section consists of technical papers on waste management and pollution control using biotechnology.

This volume is well organized; it would be useful for most biotechnologists in industry, and should likewise provide universities with a good up-to-date general reference of biotechnology applications. The subject index and the well written introductions by the editors to each of the three sections will guide the readers to valuable information. Most of the papers contain an up-to-date list of references.

As a specialist in the industrial fermentation area, I have reviewed a number of papers in this volume that might be useful for industrial biotechnologists. These include the papers on microbial growth rate measurement, analysis of fermentation gases, laboratory and equipment design for containment, as well as the overview papers on government regulation of recombinant DNA manufacturing and papers concerning regulations for new drug products. The majority of these papers are well written.

This volume is truly a comprehensive coverage of biotechnology applications

and should be a valuable resource for the practicing biotechnologist.

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#### **Thermodynamic and Transport Properties of Coal Liquids** (An Exxon Monograph)

By C. Tsionopoulos, J. L. Heidman, and S.-C. Hwang, John Wiley & Sons, 1986, 214 p. \$49.95

Over the years, various technologies have been developed to produce synthetic fuels from coal. The design and operation of coal conversion processes require data on thermodynamic and transport properties. However, the required data are not available for most properties at the conditions of interest. Current design calculations for coal conversion processes are based primarily on data and correlation methods for petroleum liquids, which rarely represent coal-derived liquids. The production of coal liquids is conducted at high temperatures, and the liquids generated differ substantially in nature from petroleum crudes. In this book the authors demonstrate the potential applications of methods developed for petroleum liquids, with slight modifications, to coal liquids at coal liquefaction conditions.

The book consists of ten distinct chapters. The first chapter presents a terse summary of the unique character of coal-derived liquids relative to petroleum fluids and key model compounds for coal liquids. The basic data needs for design calculations of coal liquefaction processes are reviewed in Chapter 2. Chapter 3 outlines methods for characterization of coal liquids. Chapters 4–9 examine the properties of interest with emphasis on elevated temperatures: vapor pressure (4), vapor-liquid equilibria (5), thermal properties (6), density (7), surface tension (8), and transport properties (9). Correlation methods used currently in the petroleum industry are applied in these chapters to the prediction of the properties of coal liquids. The text concludes with a discussion in Chapter 10 on future needs for experimental data and theoretical study, followed by two brief appendices in which inspection data for EDS coal liquids are summarized.

Two alternative approaches to properties correlation are explored: one based on

boiling point and specific gravity and the other on critical properties and acentric factor. Extensive calculations are given to illustrate how well such classical methods for petroleum fluids can be extended to highly aromatic coal liquids. Unfortunately, with the exception of vapor pressure and vapor-liquid equilibria (VLE), experimental data for many of the properties of interest are nearly nonexistent at elevated temperatures. The lack of adequate data leads to inconclusive results in the development and testing of the correlations for such properties.

As the authors freely admit, the scope of the book is limited. No introduction to the theory behind the correlations nor detailed description of the coal liquefaction processes cited is presented. It is assumed that the reader is familiar with introductory thermodynamics and is referred elsewhere for details on coal liquefaction process design. Content is confined to the development of a classical framework for the estimation of the thermodynamic and transport properties of coal liquids. Within that framework, two-parameter (boiling point and specific gravity) characterization is pursued to its point of failure. No review is provided of the multiparameter correlations developed more recently to better model the complex behavior of coal liquids. Similarly, in the study of VLE data, the authors have restricted discussion to use of the Joffe-Zudkevitch modification of the Redlich-Kwong equation of state. No review is included of alternate solubility and VLE models for coal liquids. Throughout the text, attention is focused primarily on the large database for EDS and SRC-II liquids derived from key bituminous and subbituminous coals to the exclusion of more recent data.

The monograph is written with admirable clarity and meticulous detail. By way of documentation, the authors have gone out of their way to consolidate the bulk of the early literature on the thermodynamics of coal liquids into a single source for future reference. The result is a treatise on applied thermodynamics of uncommon value in industrial practice. The authors should be congratulated for their contributions in this book.

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