- Fungal metabolism of phenols, chlorophenols, and pentachlorophenol.
- Fungal metabolism of polycyclic aromatic hydrocarbons.
- Fungal lignin degradation and decolorization of pulp and paper mill effluents.
- Fungal decolorization and degradation of dyes.

The final two chapters are:

- Fungal biosorption of heavy metals.
- Mycorrhizal fungi in rhizosphere remediation.

The author cites over 2000 publications from a variety of sources. Many of these citations are from the "waste treatment" literature but most are from the biological literature.

Suffice it to say, this is a well written, extremely well referenced, comprehensive treatment of a formerly (at least in my sphere of reading) undeveloped topic.

Gary F. Bennett*
*The University of Toledo, Department of Chemical and Environmental Engineering, Mail Stop 305, Toledo, OH 43606-3390, USA*

* Tel.: +1 419 531 1322; fax: +1 419 530 8086.
*E-mail address:* gbennett@eng.utoledo.edu

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**Propellants and Explosives: Thermochemical Aspects of Combustion, 2nd ed., N. Kubota. Wiley–VCG Verlag GmbH & Co. KgaA, Weinheim, Germany (2007). 530 pp., US$ 175.00, ISBN: 978-3-527-31424-9**

The Journal of Hazardous Materials has changed over the years, from one which published articles mainly dealing with hazardous chemicals – hazards from chemical spills and hazards from fires and explosions – to a journal mainly publishing environmentally oriented articles. Most book reviews are in the latter area. This review, however, is of a book that returns to Journal's roots.

This book is the second edition of a classic on the thermochemistry of combustion. It "... covers the thermochemical and combustion characteristics of all important types of energetic materials, such as explosives, propellants, and the new class of pyrolants, as well as related phenomena. Addressing both experimental as well as theoretical aspects, it presents the fundamental bases of the energetics of materials, deflagration and detonation, thermochemical process of decomposition and combustion, plus combustion wave structures. The book also goes on to discuss the combustion mechanisms of various types of energetic materials, propellants, and explosives, based on the heat transfer process in the combustion waves. The burning rate models are also presented as an aid to understanding the rate-controlling steps of combustion processes, thus demonstrating the relationships of burning rate versus pressure and initial temperature."

This second edition uses the same format as the first edition whose material has been updated. In the preface to the first edition, the author writes:

> "This book is divided into four parts. The first part (Chapters 1–3) provides brief reviews of the fundamental aspects relevant to the conversion from chemical energy to aerothermal energy. References listed in each chapter should prove useful to the reader for better understanding of the physical bases of the energy conversion process; energy formation, supersonic flow, shock wave, detonation, and deflagration. The second part (Chapter 4) deals with the energetics of chemical compounds used as propellants and explosives, such as heat of formation, heat of explosion, adiabatic flame temperature, and specific impulse.
>
> The third part (Chapters 5–8) deals with the results of measurements on the burning rate behavior of various types of chemical compounds, propellants, and explosives. The combustion wave structures and the heat feedback processes from the gas phase to the condensed phase are also discussed to aid in the understanding of the relevant combustion mechanisms. The experimental and analytical data described in these chapters are mostly derived from results previously presented by the author. Descriptions of the detailed thermal decomposition mechanisms from solid phase to liquid phase or to gasphase are not included in this book. The fourth part (Chapter 9) describes the combustion phenomena encountered during rocket motor operation, covering such topics as the stability criterion of the rocket motor, temperature sensitivity, ignition transients, erosive burning, and combustion oscillations. The fundamental principle of variable-flow ducted rockets is also presented. The combustion characteristics and energetics of the gas-generating propellants used in ducted rockets are discussed."

"... new to this edition are five additional chapters providing updated coverage of significant recent developments in the field, as well as the major topic of such propulsion methods as duct rockets, ramjets, pulse motors and thrusters, while appendices on flow field dynamics and shock wave propagation have also been added." The titles of these chapters are as follows:

- Emission from combustion products;
- Transient combustion of propellants and pyrolants;
- Rocket thrust modulation;
- Ducted rocket propulsion.

The book topic, being well out of my area of expertise, does not allow me to make a qualitative assessment of its content. I can say, however, that I was impresses by the elegant thermodynamic analysis.

Gary F. Bennett*
*The University of Toledo, Department of Chemical and Environmental Engineering, Mail Stop 305, Toledo, OH 43606-3390, United States*

* Tel.: +1 419 531 1322; fax: +1 419 530 8086.
*E-mail address:* gbennett@eng.utoledo.edu

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**B. Kamm, P.R. Gruber, M. Kamin (Eds.), Biorefineries—Industrial Processes and Products: Status Quo and Future Directions, Vol. 1 Wiley-VCG Verlag GmbH & Co., KgaA, Weinheim, Germany (2006). 475 pp., US$ 375.00 (for both volumes), ISBN: 3-527-31027-4**

As I began to review this book, a notice appeared on my computer announcing the construction of a biorefinery in the United States. Clearly, the topic (as the book notes) currently is very popular; green chemistry and green processes are much in the news.

In the Preface, the editors note that "...technologies for bioconversion have advanced to a state in which they are becoming practical on a large scale, economics are leaning more favorably to the direction of renewable feedstocks, and chemical process knowledge is being applied to biobased systems."

Writing in a Foreword to the book, Paul T. Anastas, Director of the Green Chemistry Institute in Washington, DC, notes:

> This book addresses the essential questions and challenges of moving toward a sustainable society in which bio-based feedstocks, processes, and products are fundamental pillars of the economy. The authors discuss not only the important scientific and technical issues surrounding this transition but also the necessary topics of economics, infrastructure, and policy. It is only by means of this type of holistic approach that movement toward genuine sustainability will be able to occur where the societal, economic and environmental needs are met for the current generation while preserving the ability of future generations to meet their needs.

This book and its companion (Volume 2) are the work product of 85 scientists from 11 different countries on three continents.

This volume has 17 chapters published under four major headings as noted below:

- Part I: Background and Outline—Principles and Fundamentals:
  1. Biorefinery systems—an overview.
  2. Biomass refining global impact—the biobased economy of the 21st century.
  3. Development of biorefineries—technical and economic considerations.
  4. Biorefineries for the chemical industry—a Dutch point of view.
- Part II: Biorefinery Systems:
  Lignocellulose Feedstock Biorefinery:
  5. The lignocellulosic biorefinery—a strategy for returning to a sustainable source of fuels and industrial organic chemicals.
  6. Lignocellulosic feedstock biorefinery: history and plant development for biomass hydrolysis.
  7. The biofine process—production of levulinic acid, furfural, and formic acid from lignocellulosic feedstocks.
  Whole Crop Biorefinery:
  8. A whole crop biorefinery system: a closed system for the manufacture of non-food products from cereals.
  Fuel-Oriented Biorefineries:
  9. Iogen's demonstration process for producing ethanol from cellulosic biomass.
  10. Sugar-based biorefinery—technology for integrated production of poly(3-hydroxybutyrate), sugar, and ethanol.
  Biorefineries Based on Thermal Chemical Processing:
  11. Biomass refineries based on hybrid thermochemical-biological processing—an overview.
  Green Biorefineries:
  12. The green biorefiner concept—fundamentals and potential.
  13. Plant juice in the biorefinery—use of plant juice as fermentation medium.
- Part III: Biomass Production and Primary Biorefineries:
  14. Biomass commercialization and agriculture residue collection.
  15. The corn wet milling and corn dry milling industry—a base for biorefinery technology developments.
- Part IV: Biomass Conversion: Processes and Technologies:
  16. Enzymes for biorefineries.
  17. Biocatalytic and catalytic routes for the production of bulk and fine chemicals from renewable resources.

Brown of Iowa State University reports that the Biomass Research and Development Technical Advisory Committee defines a biorefinery as: "A processing and conversion facility that (1) efficiently separates its biomass raw materials into individual components and (2) converts these components into marketplace products including biofuels, biopower, and conventional and new bioproducts."

The goal, of course, is to develop a sustainable society, one which does not depend on a limited resource such as oil. Thus, we turn to renewable resources to produce fuels, solvents, chemicals, plastics and food. Products that can be produced from biomass include ethanol, butanol, acetone and lactic, itaconic and amino acids. The future holds promise for much more according to the U.S. Biomass Technical Advisory Committee which is comprised of representatives of several chemical companies. The members of this committee project consumption of bioproducts will increase significantly from current use by 2030. The numbers projected include increases in biopower production from 2.8 to 5%, in biofuels from 0.5 to 20%, and bioproducts from 5 to 25%.