

Book reviews

Modeling of Combustion Systems: A Practical Approach, J. Colannino. CRC Press/Taylor & Francis, Boca Raton, FL (2006). 673 pp., US\$ 149.95, ISBN: 0-8493-3365-2

In the Prologue to this book, Colannino notes that he “. . . introduces semiempirical combustion modeling to practicing engineers and operators of fired equipment. This equipment includes boilers, process heaters, and reactors such as ethylene cracking units and ammonia and hydrogen reformers, among others. This text illustrates its examples from the field of combustion and provides the following how-to information:

- How to formulate basic theoretical combustion-related models from first principles where possible.
- How to augment these models with some adjustable parameters as necessary, or develop wholly empirical models when theory is lacking.
- How to fit adjustable parameters from data.
- How to validate such models.
- How to design experiments to collect the most data in the shortest possible time and at the lowest possible cost.
- How to model real unit behavior with engineering accuracy”.

The book has five very long chapters entitled as follows:

1. Introduction to modeling.
2. Introduction to combustion.
3. Experimental design and analysis.
4. Analysis of nonideal data.
5. Semiempirical models.

The author’s Prologue contains the following description of the material provided in this book: “The work is organized into five chapters. At its conclusion, an engineer or scientist will be able to apply the concepts in this text to real combustion problems of interest. The book provides most of the recipes for constructing the modeling equations; application to related fields using the method will be straightforward.”

Throughout, the author provides worked examples and discusses spreadsheet software.

Details of the chapters are as follows:

1. “Chapter 1 introduces modeling and includes basic model categories and analytical methods, such as dimensional analysis, the method of least squares, and a primer on linear algebra.”

2. “Chapter 2 introduces combustion. It describes most of the combustion equipment one is likely to encounter, including all manner of burners, process heaters, boilers, and some reactors.” In this chapter, descriptions are given of practical equipment that is not described very well elsewhere.
3. “Chapter 3 introduces experimental design. It covers the standard fare for design of experiments, including important statistics, the analysis of variance, two-level factorial and fractional factorial design, second-order designs, and sequential design strategies.”
4. “Chapter 4 shows how to analyze nonideal data such as plant and historical data, nonorthogonal data, and some diagnostics or hidden extrapolation, and some postanalytical procedures. We then treat analysis of designs with restricted randomization such as nested and split-plot designs, and rules of variance on balanced data.”
5. “Chapter 5 . . . draws together the individual chapters to combine theoretical models with experimental and analytical strategies for constructing semiempirical models. These include models for NO_x and CO; many NO_x reduction strategies, such as flue gas recirculation; premixing, staging, blending, and postcombustion strategies, such as selective catalytic and noncatalytic reduction.”

The book also contains much useful format material. The Table of Contents is quite complete, running 15 pages that include a complete list of tables, figures and appendices. Nomenclature used in the book is presented in the Preamble. That section is 13 pages long. Finally, the author ends the book with eight Appendices that include, among other things, a kinetics primer and an equilibrium primer.

This book is not for the faint hearted. The theory and mathematical derivations are significant and a little more challenging than the author believes. He says someone without any special expertise in the field and only some college engineering courses can successfully utilize the material in the book. I think he is an optimist as the mathematical and statistical analyses are complex. However, those engineers able to handle the material will possess a well-written text that thoroughly covers combustion system design.

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.

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Environmental Impacts of Treated Wood, T.G. Townsend, H. Solo-Gabriele (Eds.). CRC Press/Taylor & Francis, Boca Raton, FL (2006). 519 pp., US\$ 139.95, ISBN: 0-8493-6495-7

One of the chapters in this book discusses the Management of Risk of treated wood. It concludes with these words:

“Treated wood is a very useful product. It allows the use of wood in situations that would quickly destroy untreated wood, saves time and money associated with construction and maintenance, saves trees and has all the ease of use associated with regular wood. . . . However, as with any product, treated wood will continue to change with time. Newer and better wood preservatives will replace the current ones. The risk associated with the new preservatives will likely be less. This reduction in risk should not lead to complacency. The basic principle that treated wood is a wood product with a pesticide in it will still apply. So will the basic principle that a wood preservative must be toxic in order to fulfill its function.”

The above comment is in one of the 26 papers contained in this most excellent book. The editors are to be congratulated for assembling this material on a very current topic. The book is an outgrowth of a conference held in Orlando, Florida in 2004 and contains papers categorized under four major headings which are as follows: (1) Introduction and Background (4 papers); (2) Environmental Impact (7 papers); (3) Assessing and Managing Human Health Risk (7 papers); (4) End-of-Life Management Impacts (9 papers).

The first paper in the book discusses chromated copper arsenate (CCA), which is used as a wood preservative. In this paper, the author notes that issues related to disposal of material treated with the above noted compound as well as public concern for the presence of arsenic in the system has led chemical suppliers to voluntarily cease the use of this material for residential applications. This decision has resulted in the substitution of amine copper quaternary and amine copper azole, which eliminate the risks associated with chromated arsenate. However, there still exist large quantities of CCA-treated materials still in service and the debate about the ultimate fate of these materials is thoroughly discussed. Other papers review organic biocides such as creosote and pentachlorophenol.

Environmental impacts are thoroughly covered in Section 2. In the preamble to this section, the editors write:

“As described in Section 1, wood-preservative chemicals are designed to extend the service life of treated wood products by inhibiting the biological organisms that would otherwise result in deterioration of the wood. Leaching or migration of preserved chemicals during the product’s intended use is one possible consequence of preservation. By their nature,

preservative chemicals are toxic to some organisms at sufficient exposure, so their release into the environment may result in adverse impact to nontarget organisms, including humans. Section 2 contains seven chapters which describe the topic of release of preservative elements to the environment and the possible impact on ecosystems.”

One of the papers in this section discusses the “Leaching of chromated copper arsenate, alkaline copper quaternary and copper azole components from wood exposed to natural weathering above ground and reaction of leachates from soil.” The author notes that coatings are very effective for reducing the leaching of all preservatives, as long as the coating is intact.

Section 3 discusses the health risks resulting from preservatives leaching from treated wood products. Release of arsenic from treated lumber is discussed in detail. Arsenic related cancer is one of the topics explored.

In Section 4, the papers discuss the management of disposed treated wood. Discussed are the minimization of those risks as well as issues pertaining to the disposal of treated wood. Different management strategies for handling this waste stream are reviewed. Topics in the final book section include the reuse of treated wood and the recycling of treated wood products. Remediation approaches include bioremediation of treated wood with bacteria, bioremediation of treated wood with fungi, electro-dialytic remediation of wood treated with chromated copper arsenate, thermal treatment technologies and disposal in landfills.

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: gbenett@eng.utoledo.edu

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Industrial Waste Treatment Handbook, 2nd ed., Woodward & Curran, Inc., Butterworth-Heinemann, Burlington, MA (2006). 532 pp., US\$ 99.95, ISBN: 0-7506-7963-8

The second edition of this book was produced by members of the Woodward & Curran organization, an environmentally oriented consulting firm. The focus of the contributors was on industrial waste which they note requires distinctly different treatment approaches than utilized for municipal wastes.

The authors write:

“Industrial waste treatment thus encompasses a wide array of environmental, technical, and regulatory considerations. Regardless of the industry, the evaluation and selection of waste treatment technologies typically follows a logical