

Book reviews

Combustion and Gasification in Fluidized Beds, P. Basu. CRC/Taylor & Francis Group, Boca Raton, FL (2006). 491 pp., US\$ 129.95, ISBN: 0-8493-3396-2

In the preface, Basu notes that several thousand fluidized bed boilers are in operation around the world, many of which were designed to produce clean energy from fossil and biomass fuels. As a consequence, the use of fluidized beds for energy production is increasing, but Basu notes that there was no comprehensive book describing the basic design and operating principles of fluidized bed gasifiers and boilers.

In the preface, he describes the book's contents as follows:

"The book is comprised of 13 chapters and 4 appendices, including 7 tables that are useful for the design of fluidized bed equipment. The first chapter introduces readers to fluidized bed boilers and gasifiers while comparing other options for power generation from fossil or biomass fuels. Chapter 2 covers the basics of fluidized bed hydrodynamics. Chapter 3 discusses the fundamentals of gasification and its application to the design of fluidized bed gasifiers. Basics of combustion of solid fuels and its application in different types of fluidized beds are presented in Chapter 4. Chapter 5 concentrates on the pollution aspects of fluidized bed plants including issues related to climate change mitigation. Heat transfer in fluidized beds is discussed in Chapter 6. Chapter 7 pulls together information from earlier chapters to explain how bubbling fluidized bed boilers work and how these are designed. A comprehensive treatment of circulating fluidized bed boilers is presented in Chapter 8. The relevance of design and feed stock parameters to the operation of such boilers is also discussed in this chapter. Chapter 9, which discusses issues related to construction and maintenance of fluidized bed equipment, covers the construction materials exposed to special service conditions in fluidized bed gasifiers and boilers.

A fluidized bed boiler or gasification plant also includes several mechanical components, such as feeding systems, air distribution grids, gas-solid separators, and solid recycled systems, which are discussed in Chapters 10–13, respectively. Appendix 1 discusses relevant physical characteristics of granular solids typically used in fluidized beds. Calculations needed for the heat and mass balance of combustion reactions are presented in Appendix 2. A simplified model for computation of sorbent required for sulfur capture is given in Appendix 3. Useful data for design and other calculations

related to fluidized bed equipment are presented in a series of tables in Appendix 4."

Much of the material in the book (regarding the technical aspects of combustion) is beyond me, but I am sure will not be to practitioners in the field as the writing is clear, the diagrams numerous (and well done), and worked examples of design problems are liberally included throughout the book.

Personally, I was most interested in the air pollution aspects of boiler design and operation. To this end, I read with interest Chapter 5 (Emissions) and Chapter 12 (Gas–Solid Separators). Of the two, the latter chapter was, in my opinion, better. In it, the author discusses particulate removal by cyclones, impact separators and inertial separators. This chapter was one of the most thorough and technically chapters written on the topic that I have seen. The other chapter (noted above) deals with the subject of air pollution in general. I had minor problems with this chapter. Table 5-1, for example, entitled "Air Pollution Emissions in the United States," reports 1983 data. This is far out of date. Table 5-2, which discusses emissions from boilers, contains 1994 data in contrast. The data contained in Table 5-4, on "National Standards of Emission from New Coal-Fired Boilers for a Typical 150MWe Capacity Boiler," was adapted from a 2004 publication.

The problem of SO₂ emissions and their control is well discussed including SO₂ removal by calcination. Technical details of SO₂ removal in fluidized beds are given. Following this discussion, emissions of NO_x, CO₂, trace organics, and particulates are addressed.

In summary, it is my opinion that Basu has written a very detailed and useful text on the topic of combustion and gasification emissions. It should become a well-used reference for engineers and students interested in design and operation of fluidized beds.

G.F. Bennett*

*Department of Chemical and Environmental Engineering,
The University of Toledo, Mail Shop 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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