BOOK REVIEWS

Circulating Fluidized Bed Boilers: Design and Operations

By P. Basu and S. Fraser, 1423 pp.

This book is very useful for introducing engineers to the design and operation of circulating fluidized-bed (CFB) boilers and is probably the best book available for this purpose. It provides a reasonably comprehensive review of the state-of-the-art engineering design and application of circulating fluidized-bed boilers. One of the best features of this book is that it not only provides useful insight into the design and operation of the circulating fluidized-bed boiler, but it also provides readers with knowledge about air pollution, waste disposal, and materials selection. Although it contains a great deal of description and analysis of the phenomena associated with circulating fluidized-bed boilers, it lacks advanced mathematical formulation of the process. In view of recent advances in computation and numerical analysis, the mathematical description of the overall system including mass, momentum and energy equations and computational techniques is considered the state-of-the-art in circulating fluidized-bed process design.

Chapter 1 presents an excellent introduction to circulating fluidized-bed boilers with a strong emphasis on features, application and advantages of circulating fluidized-bed systems in different areas.

Chapter 2 includes reviews of fluidization and hydrodynamics which are treated empirically with a significant emphasis on cluster formations and their roles. Although radial distribution and solid mixing are discussed, this chapter primarily describes one-dimensional (plug flow) behavior.

Chapter 3 includes a clear description of the heat-transfer mechanism in circulating fluidized-bed boilers and empirical correlations for heat-transfer parameters.

Chapter 4 explains clearly combustion of coal particles, devolatilization, char combustion and behavior of particles in circulating-bed combustion, particularly in the illustrated examples. It also includes phenomena that affect combustion such as particles collision and attrition. However, this chapter lacks a detailed discussion of agglomeration and slag formation which are important phenomena during the combustion process.

Chapter 5 discusses emission and gaseous pollutants such as SO_x, NO_x, CO and HC, with their standards, which are emitted during combustion. Although this chapter includes very useful information, much more has been developed in the literature, particularly in sulfur removal, which is not included.

Chapter 6 provides essential tools and major steps involved in the design of circulating fluidized-bed boilers using available correlations with a good illustrative example at the end.

Chapters 7 and 8 present available basics of engineering design and correlations essential to design different components of circulating fluidized-bed systems including cyclone, internal separators, nonmechanical valves (solid feed system) and gas distributors. The discussions are very clear and demonstrate state-of-the-art fundamentals of engineering design available in the literature. Furthermore, the chapters examine the relevance of different associated components to the operation of the CFB boilers.

Chapter 9 describes the nature of excess solid waste produced by CFB boilers with SO_x emission control and suggests possible utilization and disposal of the solid waste. This chapter is one of the best features of this book. In addition to the design of the system, it educates the readers about an important environmental consideration.

Chapter 10 briefly discusses materials selection criteria and possible associated problems such as erosion and corrosion. It introduces readers to an important issue of different materials and their roles and makes an engineer aware of potential problems.

In summary, the book provides engineers and undergraduate students with insight into the design and operation of CFB boilers with brief discussion of important environmental issues and materials selection. Although more advanced design tools and a more mathematical approach are more suitable for graduate students and researchers in this area, this book offers all readers a basic understanding of concepts, application and many aspects of CFB boilers.

Hamid Arastoopour
Dept. of Chemical Engineering
Illinois Institute of Technology
Chicago, IL 60616

Diffusion in Zeolites (and Other Microporous Solids)

By Jörg Kärger and Douglas M. Ruthven, Wiley, New York, 1992, 605 pp.

Since the invention of the low (near-ambient) temperature route to their synthesis in the 1950s, zeolites have found major and widespread industrial applications, first in adsorptive separation/purification and shortly thereafter in catalysis. In the main applications being practiced today, such as air (O_2/N_2) separation, hydrogen purification, and fluid catalytic cracking, diffusional limitations to intracrystalline mass transfer generally have a negative effect and hence are referred to as a "resistance." A better understanding of the pore diffusion processes could lead to better designs of sorbents and catalysts. In a few situations, diffusional resistance is exploited to achieve the desired separations (for example, kinetic separations of air and CO_2/CH_4) or to control the desired cat-