

Preface

This monograph is designed to provide practicing engineers, students, and researchers with insights into the operation and principle of the working of circulating fluidized bed (CFB) boilers. Prior exposure to the process of gas–solid fluidization is not essential for full comprehension of this book. It provides boiler operators, and maintenance and other engineers involved in steam generation or in the manufacture of circulating fluidized bed boiler an appreciation of the process, its capabilities, and its limitations. Experienced fluidization researchers are able to see how basic principles are applied to the design of circulating fluidized bed boilers.

This book includes 11 chapters, 4 appendices, and several tables of design data, which are useful for planning and design of fluidized bed process equipment including CFB boilers. Chapter 1 introduces readers to circulating fluidized bed boilers and compares this technology with others. Chapters 2–5 cover the basics of hydrodynamics, heat transfer, combustion, and gaseous emission, with emphasis on their application in CFB boilers. Chapter 6 pulls together information from other chapters and molds them into a generic approach to the design of CFB boiler. The relevance of design and feedstock parameters to the operation of a circulating fluidized boiler is also discussed in this chapter.

Designs of mechanical components of a CFB unit like cyclone, air-distributing grid, and solid recycle system are discussed in Chaps. 7 and 8. Disposal and/or utilization of solid wastes are major facets of the operation of a CFB power plant and are discussed in Chap. 9. Circulating fluidized bed boilers need some special consideration with construction materials. Chapter 10 discusses such material issues.

Presently, thousands of CFB boilers are in operation around the world in a wide range of operating and fuel conditions. Many operational challenges are cropping up. Chapter 11 discusses those operating and maintenance (O&M) issues.

Appendix I discusses physical characteristics of solids relevant to fluidization, while Appendix II presents basic stoichiometric or combustion calculations. Appendix III presents a simplified model for sulfur capture in a CFB boiler furnace. Appendix IV presents some design data that could aid in the design of CFB boilers.

The materials in this book first appeared in 1991 when CFB boiler had just started developing. The CFB boiler technology has matured considerably in the last two decades. During this period, the author carried out extensive research on combustion, heat transfer, loopseal, and design methodologies. Additionally, he conducted numerous professional training courses on CFB boilers around the world, and taught graduate courses on fluidized bed boilers at Dalhousie. The present book is an updated version of the 1991 book with materials matured through interaction with practicing engineers over two decades and new knowledge added to this topic through research in this period. An additional chapter on O&M is included here to make it more relevant to the need of fluidized bed boiler industries of today.

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