Foreword

In contrast to the situation for other gas-solid reactors such as fluidized beds, the rotary kiln reactor has so far lacked an authoritative treatment in a single book. Process engineers, operators, designers, researchers, and students have struggled with a widespread collection of papers, from many industries, with key articles and classical contributions that are over forty years old and difficult to access. At the same time, new applications for the kiln have arisen, new fuels are being used, and new tasks—such as waste incineration—are being applied to kilns originally designed for other uses. Much improved understanding of bed processes has been developed in the past decade or so, and tools for design and analysis of existing operations, such as computational fluid dynamics, have evolved from rare to widespread use. There has been a pressing need for these developments to be brought together and assessed such that the kiln engineer, for example, can appreciate what can be achieved from different types of mathematical modeling and so that the fluid-particle researcher can understand what has been accomplished by recent research and where further effort is needed. The timely publication of this new book, *Rotary Kilns: Transport Phenomena and Transport Processes*, by Akwasi Boateng, admirably fills this gap.

Written by an engineer gifted in his understanding of the fundamentals of fluid-solid systems and their mathematical modeling, and having extensive experience in rotary kiln practice, the book provides the reader with a unique vantage point from which to analyze rotary kiln processes. The book provides a clear exposition of kiln behavior and of the bases and assumptions of the various mathematical models used to describe it. Examples are provided for the purposes of illustration.

In terms of the content, *Rotary Kilns: Transport Phenomena and Transport Processes* provides chapters devoted to the kiln's basic description and to its numerous applications. Several chapters on freeboard

processes, aerodynamics, combustion and flames, and heat transfer are linked to a detailed exposition of bed processes, including particulate behavior, granular flow models, mixing and segregation, and heat transfer and their effects on kiln performance. Overall mass and energy balances, measurements, and site surveys are presented in the penultimate chapter, after the reader has been well prepared by the prior treatment of the individual processes, rather than at the beginning of the book. The final chapter contains practical information on several key rotary kiln processes in the minerals industry. An extensive appendix is included.

Readers will find this book starts most topics at a very basic level. Some examples of this are the chapters on combustion and on mass and energy balances. Soon, however, the complexities become evident, such as in the chapters on granular flow and segregation.

This book will become a benchmark for the study of rotary kiln phenomena, for the design of new rotary kiln processes, and for the modeling and analysis of existing processes. It will be an indispensable addition to the bookshelves of engineers in the cement, lime, pulp and paper, and mineral industries. It will prove invaluable to researchers and academics studying the complexities of solid-gas flows, mixing, and transport processes.

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