PREFACE

In chemical manufacturing and oil refining, as well as in environmental considerations of air and water, numerous chemical compounds participate in many chemical reactions. The first article in volume 24 of *Advances in Chemical Engineering,* "Kinetics and Thermodynamics in Multicomponent Mixtures," provides a systematic treatment of this subject. One of the authors is Professor Gianni Astarita of Naples, an outstanding innovator and seminal thinker who recently passed away. The readers must master linear algebra and stoichiometry in the first part before reaching the nuggets in thermodynamics and kinetics.

The thermite process may be the original inspiration of combustion synthesis (CS), a relatively new technique for synthesizing advanced materials from powder into shaped products of ceramics, metallics, and composites. Professor Varma and his associates at Notre Dame contributed the article "Combustion Synthesis of Advanced Materials: Principles and Applications," which features this process that is characterized by high temperature, fast heating rates, and short reaction times.

We have all read about the impact of large-scale computation in fields such as the design of aerospace vehicles, the exploration and production of oil and gas, and the design of new drugs—as fallouts from the national investments in weapons design. Professors Kuipers and van Swaaij of Twente University have applied computation fluid dynamics (CFD) to the analysis and design of chemical reactors, particularly in multiphase flow reactors. The graphic display of their computations will add immeasurably to our understanding of what happens in fluidized beds.

The chemical engineering community needs a broader understanding of actual industrial cases before we can make progress in environmental engineering. This gap is addressed by Roland Schmitt and his associates at Amoco Corporation in the article "Using Relative Risk Analysis to Set Priorities for Pollution Prevention at a Petroleum Refinery," which describes a joint project between Amoco and the Environmental Protection Agency to identify opportunities for preventing pollution at a refinery in Yorktown, Virginia.

These four chapters constitute reviews that will inform the chemical engineering community about important developments in science and technology and will serve as starting points for further advances.

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