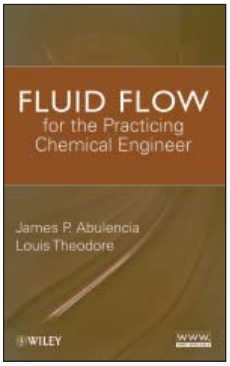
Books

Fluid Flow for the Practicing Chemical Engineer

James P. Abulencia and Louis Theodore, John Wiley & Sons, Hoboken, NJ, 600 pages, $110, July 2009, ISBN: 978-0-470-31763-1



Fluid flow and fluid mechanics have been covered in many books, but only a handful deal specifically with fluid flow in chemical engineering operations. This book is one of those.

The book's first section establishes a foundation in the technology. Opening chapters provide a history of chemical engineering fluid flow, terms and definitions, and a discussion of transport phenomena versus unit operations. Introductory material on Newtonian fluids and non-Newtonian flow is rather cursory, but helps to instill an understanding of fluid flow equipment design and operation.

The second section covers basic laws that are germane to all practicing engineers — including Conservation Law for Mass, Conservation Law for Energy, Conservation Law for Momentum, Law of Hydrostatics, and Ideal Gas Law.

A section on fluid flow classification follows, covering topics such as fluid flow mechanics, laminar flow, and turbulent flow. A chapter on two-phase flow is limited in scope; there is no discussion of flow in vertical piping or flow regime maps, which are important in industrial practice. Hopefully, the authors will correct this in the next edition.

Fluid flow transport and applications — including prime movers (fans, pumps, and compressors), valves and fittings, flow measurement, and ventilation — are well-covered in the book's next portion. Examples illustrate how the concepts discussed in the prior chapters are applied.

Another section on fluid-particle applications deals primarily with theory, with little information provided on equipment. Chapters are devoted to particle dynamics, sedimentation, centrifugation, flotation, porous media and packed beds, fluidization, and filtration.

The book also highlights seven topics that the Accreditation Board for Engineering and Technology (ABET) has recently indicated should be included in any engineering curriculum. These topics include environmental management and accident and emergency management. In these discussions, I felt that more information on fluid flow applications in process safety should have been included (*e.g.*, calculation of pressure drop in relief device vent piping). Also addressed are other topics on the roster of ABET-recommended subject matter, including engineering ethics, numerical methods (including computing), economics and finance, and biomedical engineering (the book includes a discussion of the human cardiovascular system from a fluid flow perspective). A final chapter presents open-ended problems — describing approaches to situations for which there is usually no unique solution.

Two subjects of industrial importance that I would have liked the authors to have included are slurry flow and unsteady-state flow problems (*e.g.*, calculation of drain time of a liquid flowing by gravity from a vessel through piping, and calculation of discharge time of a gas from a pressure vessel to the atmosphere).

This book provides many examples, and each chapter offers references (although many are relatively old). These supplements enhance the usefulness of the volume, which should be a valuable textbook for an undergraduate course on fluid flow and fluid mechanics for chemical engineers.

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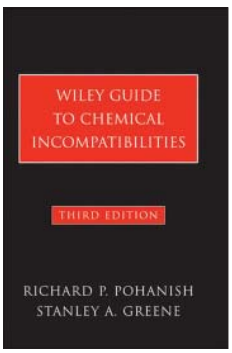
Wiley Guide to Chemical Incompatibilities, 3rd Edition

Richard P. Pohanish and Stanley A. Greene, John E. Wiley & Sons, Hoboken, NJ, 1,100 pages, $175, Aug. 2009, ISBN: 978-0-470-38763-4



Identifying chemical reactivity hazards and managing them properly is a key part of the job of every chemist and chemical engineer. These hazards may arise in the form of unstable chemicals, unintentional mixing of incompatible chemicals, and intended chemical reactions that get out of control. The new third edition of "The Wiley Guide to Chemical Incompatibilities" is a good reference for practitioners involved in the former two categories.

This updated and expanded reference compiles chemical reactivity data for more than 11,000 compounds, including 9,000 incompatibility profiles — significantly more data than are available from any other source. Chemicals are listed in alphabetical order by a variety of names, including IUPAC name, common names, and trade names. This approach generally enables the user to find data for the chemical in question, although not quite as easily as the somewhat less comprehensive but well-indexed "Bretherick's Handbook of Chemical Reactivity" (Elsevier). The new Wiley Guide also lacks the structure drawings available in the competitive work, which can be useful in

identifying the chemical being researched.

A bigger drawback of this book is its title. "Chemical Incompatibilities" hints that the book contains information about hazardous chemical interactions, but it may also suggest that it addresses other types of incompatibilities — such as those that might arise in chemical formulations, two-phase mixtures, and so on. To demonstrate the potential confusion, a Google search on "reactive chemicals" does not identify this book.

An excellent companion to "The Wiley Guide to Chemical Incompatibilities" is the NOAA Chemical Reactivity Worksheet, available as a free download at http://response.restoration.noaa.gov/chemaids/react.html. Although not as comprehensive as the Wiley book, the Worksheet provides data on hazardous chemical interactions of individual chemicals and pairs of chemicals, while assisting the user in preparing a chemical interaction matrix in support of process design and hazard analysis.

Another useful resource is the AIChE/CCPS book "Essential Practices for Managing Chemical Reactivity Hazards" (www.aiche.org/Publications/).

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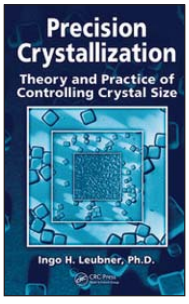
Precision Crystallization: Theory and Practice of Controlling Crystal Size



Ingo H. Leubner, CRC Press, Boca Raton, FL, 216 pages, $200, Sept. 2009, ISBN: 978-1-439-80674-6

Crystalline materials make up an estimated 80% of chemical and pharmaceutical products. Yet few resources have been available to offer chemists and product engineers practical guidance on achieving precision control of crystal size and size distribution — an important factor in product applications.

This volume presents the tools to control crystal nucleation — the key to controlling crystal size and size distribution for batch and continuous crystallizations.

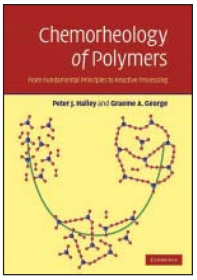
Based on the author's balanced nucleation and growth (BNG) model, the book demonstrates how the results of the nucleation process are quantitatively related to practical experimental control values — such as reactant addition rate, crystal solubility, temperature, residence time, and the effect of ripening agents (crystal supersizing) and crystal growth restrainers (crystal nanosizing) during nucleation.

The author shows how the BNG theory predicts previously unknown phenomena, and how it corrects erroneous perceptions of the importance of reaction volume on the outcome of crystal nucleation. Going beyond classical nucleation theories (which often rely on guesswork), the BNG model gives precise guidance to chemical engineers, chemists and other scientists working in research, quality control, product development, production processes, pilot plant operations, and manufacturing.

The concepts in the book have been applied to the precipitation of inorganic materials such as silver halides in the photographic industry, and to organic systems such as latexes, dyes, and pigments. Other applications are for crystalline materials used as pharmaceuticals, catalysts, and imaging systems for separations and surface modifications.

The book contains information that has not been previously available, and offers a unique opportunity for the reader to learn up-to-date principles for precision controlled precipitation.

Chemorheology of Polymers: From Fundamental Principles to Reactive Processing



Peter J. Halley and Graeme A. George, Cambridge University Press, New York, NY, 454 pages, $150, June 2009, ISBN: 978-0-521-80719-7

Plastics are the most diverse materials in use today, and the increasing reliance on high-performance plastics demands new ways of manufacturing polymers. One way of doing this is through reactive processing, the dynamics of which place new demands on characterization, systems monitoring, and control of the complete manufacturing process.

The volume is a comprehensive resource for researchers and practitioners working in reactive polymers and processing. The book's extended introduction is devoted to the chemistry and physics of thermoplastics, thermosets and reactive polymers. Polymer characterization tools related to reactive polymer systems are then discussed in detail, with emphasis on techniques that can be adapted to real-time process monitoring.

The core of the book focuses on the understanding and modeling of the flow behavior of reactive polymers (chemorheology) — a complex subject, as it involves the changing chemistry, rheology and physical properties of reactive polymers and the interplay among these properties.

This book differs from many other texts on reactive polymers due to its breadth of coverage. It offers a complete review of the practical industrial processes used for polymers, and provides insight into current chemorheological models and tools used to describe and control each process.

The book should be useful to advanced students and researchers, as well as industrial practitioners wishing to move into the field of reactive polymer systems.