BOOK REVIEWS

The Kinetics of Industrial Crystallization

By J. Nývlt, O. Söhnel, M. Matachová, and M. Broul, Elsevier, 1985, 340 pp., $67.25.

The authors have set out to collect all the important information scattered in the literature that they feel is basic to the description of kinetics of crystallization, while simultaneously attempting to use a unified approach to the individual situations. They have been remarkably successful, and have produced a monograph that covers the whole of this enormous field quite well.

After a brief introduction the authors discuss the driving force for crystallization, and clarify an oft-neglected topic, the choice of concentration units and the difference this choice causes in definitions of supersaturation ratios and relative supersaturations. Chapter 3 is a long, 144 page chapter on nucleation in which 44 pages are devoted to secondary nucleation—the principal mechanism in industrial crystallizers. Chapter 4 (66 pp.) on crystal growth, discusses the various models, including the screw dislocation mechanism, which is the one most commonly observed in practice. Chapter 4 also covers the effect of additives on crystal growth, the spread in growth rates among individual crystals, and methods of measuring growth rates. Chapter 5 (69 pp.) evaluates nucleation and growth kinetics from model experiments in terms of the crystal population balance and the crystal size distribution, and also describes the techniques used in these model experiments. Chapter 6 is on precipitation processes and how they differ from other crystallization systems. The last chapter covers other processes affecting the crystal size distribution, such as ripening, recrystallization, and coagulation and agglomeration.

This book is a welcome addition to the literature on crystallization. The authors have gathered in one place an enormous amount of information—the references to the chapters take up 18 pages. And the references include many from eastern European journals, which are less well known or even unknown to most western engineers. However, the lead time for this book seems fairly long, for the most recent references are to 1982 publications, and there are only four of them.

It is much easier to complain about what one does not like about a book than to express what one does like. I do like this book. It covers a broad field, and covers it well. It covers both the nucleation and growth aspects of crystallization. It emphasizes and goes into the details of the principal mechanism of crystal formation—that of secondary nucleation. It discusses the principal technique for analyzing model experiments—that of population balance analyses from crystal size distributions. It has a good discussion on the techniques of modelling, including apparatus used, the time necessary to establish steady state conditions, and methods of sampling. It has a very good section on deviations from an ideal mixed suspension, mixed product removal crystallizer, and it covers both batch and continuous crystallization.

This book, a first edition full of data and equations, does have numerous minor errors. For example, the reference to Bransom, p. 339, is given as 1979 when it should be 1959. Berglund is referred to on p. 224, but is not listed among the references. There are a number of minor typographical errors, such as the unbalanced parentheses in equation 4.63. My major complaint, however, is the difficulty in following the nomenclature. The table of nomenclature, as the authors state, is not complete, and does not list units with the definitions. Units would be helpful in many cases, such as for s, defined only as "supersaturation rate." With a complete table, including units, the book would be much easier to read. In a related matter, the axes on most of the graphs are marked only with symbols, not names, and sometimes the units are omitted.

The authors go into adequate detail in most instances, but in a number of cases a little more explanation would add clarity and aid comprehension. On p. 155 they just mention that crystal "planes . . . with greater linear growth rates will disappear." It is very easy to explain this with a simple diagram, but as written it would be difficult for someone with little background in this area to understand. In section 5.2.1, "Derivation of the population balance," the authors should, but do not, give the derivation, for it is not too difficult. They just state the assumptions and give the final differential equation.

I have but a few disagreements with the authors. In section 5.2.5, "Inadequacies of the population balance method," they argue for the superiority of the cumulative size distribution curve over the differential size distribution (or frequency) curve. I believe that one is just as good as the other, as one is the derivative of the other, and one can always transpose one into the other. How to best handle and treat the data is another question. As the authors rightly point out, in plotting the differential distribution from sieve (or any other classified) data one should not draw the curve through the mean size for a particular class. The preferred technique, not mentioned, is to plot the histogram, and then draw the curve such that the area above the mean frequency for a size class equals the area below.

One minor point is on p. 311 where the authors mention that ripening is completely new in industrial crystallization. They are unfamiliar with the photographic industry, where the ripening of silver halide crystals for photographic "emulsions" is an old art.

This book is a first edition. I hope there will be future editions where the shortcomings can be corrected, in order to bring it from a good book to an excellent one. The shortcomings make this work harder to read and to use, but in spite of them, this book is to be highly recommended to all engineers and scientists working in the field of industrial crystallization. With some supplemental material, it can also be used as a text.

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Catalysis of Organic Reactions (Chemical Industries Series, Vol. 22).

Edited by Robert L. Augustine, Marcel Dekker, Inc., 1985, 416 pp., $75.00.

Catalysis of Organic Reactions is a collection of papers first presented at the Tenth Congress on Catalysis in Organic Reactions, Williamsburg, VA (1984). It contains 22 contributions by 51 authors on a wide variety of topics in catalysis. These papers are grouped into five parts: homogeneous catalysis; H2-CO reactions; heterogeneous catalysis; catalytic oxidation; and selected topics.

The volume encompasses an impressively wide spectrum of catalytic systems. The contributions are divided roughly in half between homogeneous and heterogeneous catalysis. Most discuss catalysis of specific reactions, such as oxidation of olefins to glycols or epoxides and sulfides to sulfoxides, hydroformylation of alkenes, hydrogenation of phenols, and aminomethylation of diene polymers. A smaller number deal with synthesis of novel catalysts such as stereospecific catalysts and molecularly-dispersed bimetallic catalysts. Also included are contributions about bacterial oxidation of hydrocarbons and the use of single crystals as model catalysts.

Catalysis of Organic Reactions is primarily a collection of research reports and not a review of this important area of catalysis. A small number of the papers do review current work; notable among these are Jack Lundsford's contribution titled "Methanol Synthesis over Supported Palladium Catalysts" and D.W. Goodman's paper on the use of single crystals as model catalysts. However, the majority of the contributions detail the recent work of the individual authors. Most of the papers are quite up to date, discussing developments through 1984.

As one might expect, organization of such a variety of topics into a logical order is quite difficult. Unfortunately, the editor has broken the book into five subheadings that overlap each other significantly. As a result, several of the papers appear out of place. For example, two reports about supported catalysts are found in the section about homogeneous catalysis, while a number of reports about homogeneously-catalyzed reactions are found in later sections of the book. It might have been more useful to divide the papers into broader subheadings such as organic oxidations, organic reductions, and catalyst design and analysis.

The cover notes that accompany *Catalysis of Organic Reactions* hail it as "comprehensive and definitive" and a "remarkable advance in the field." These accolades appear to be a bit optimistic. The book does indeed cover a great deal of ground in catalysis, but the topics discussed are quite specific, and little attempt is made to summarize or generalize. The topics presented are fascinating, but the presentations are often a bit esoteric for nonexperts in each specific field of catalysis. Overall, this volume offers a small view of a wide variety of topics in organic catalysis. Unfortunately, its impact and importance are diminished by the narrowness of each of the individual contributions and its overall lack of continuity.

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Measurement Techniques in Heat and Mass Transfer

By R. I. Soloukhin, and N. H. Afgan, Hemisphere Pub. Corp., 1985, $84.50.

As Proceedings of the International Center for Heat and Mass Transfer, the contents of this book have already been through a review process. One can assume that the papers in the book were selected from among many submitted prior to the XV ICHMT Symposium. Therefore, the content and quality of the papers should be among the best available to the review personnel at the time of the initial selection.

The new measuring methods presented quite apparently are state-of-the-art methods using computers for data acquisition and numerical methods for analysis. Many could be adapted for use in industrial process control systems. At this point in time such a capability is an important quality for any measurement procedure.

A wide variety of measurement techniques is presented. Most of the papers describe fairly specific and sophisticated measurement techniques. These definitely are designed primarily for experimental research purposes, but some of these procedures could be adapted readily for industrial development or production applications. The survey paper on "High Temperature Measurement" (Maglic) is of general interest, and most of the papers in the section on "Power Engineering Measurement" are of direct value to pertinent industries. With regard to the level of sophistication required of potential readers, with their background in the unit operations and transport theory and their broad educational training in engineering and the sciences, chemical engineering students in the sixth semester of their eight-semester curriculum should be able to understand and apply the principles and theory involved in most of the papers.

The organization of the text material is appropriate for a book of this nature. The translations of articles from foreign sources are generally good. However, there are errors in spelling and in grammar which should have been caught in their final proofreading. Some of these are obvious, but they do not detract significantly from the overall high quality of the book.

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