BOOK REVIEW: Crystallization

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in this section include computer simulation of crystal growth, growth kinetics in various systems, and a particularly important paper by Janse and DeJong on growth dispersion. The key concept of growth dispersion is that crystals in a magma do not grow uniformily, and in developing a population balance this factor may be important in describing what is going on within the system. Janse and DeJong do a particularly good job in describing the phenomenon and its influence on crystal size distribution.

Professor R. Boistelle is the author of the review on crystal habit modification. Habit modification almost always requires a trial-and-error experimental program and, accordingly, there are few general models or concepts applicable to broad categories of solvent-solute combinations. A review of this subject is, therefore, seldom satisfactory. Professor Boistelle has nevertheless written a short, well organized and thoughtful review of the field. The research results presented in this section are excellent but most likely one must be interested in the specific system investigated in order to make use of the results.

The section on crystallizer design is outstandingly good, particularly the review presented by Professor J. W. Mullin. Professor Mullin gives a good state-of-the-art presentation of design requirements, basic crystallizer types and laboratory or pilot plant experiments required to obtain design data. He also presents a good list of research topics which should challenge crystallization researchers. Toussaint and Fortuin present an excellent discussion on the variables that play a key role in the design of draft tube and baffle crystallizers. Toyokura presents graphical design techniques and Asselbergs and DeJong discuss the relationships among mass, energy and population balances, heat transfer and other variables which affect crystallizer design. There are also papers on batch crystallizer design and crystal size distribution analysis.

No comprehensive review is attempted for the section on crystallizer operation and case studies. This section, however, should be very valuable for researchers who do not have direct access to in-plant experience with crystallizers and for those teaching crystallization operations. Among the manuscripts on operation characteristics are papers dealing with design models for transient behavior, stability, classification, fractional crystallization and direct contact cooling. Case studies on NaCl and KCl plants are presented.

In summary this book covers a broad field but gives in-depth coverage to selected topics. As with all compilations of research papers, the lack of a uniform set of nomenclature could cause the reader difficulty. It is not intended to be a teaching text; Professor Mullin's book *Crystallization* or the book by Randolph and Larson, *Theory of Particulate Processes*, are more useful for this purpose. Researchers and practitioners should find the book to be a useful compilation of relevant papers, reviews and experiences. □

ChE book reviews

THE NATURE AND PROPERTIES OF ENGINEERING MATERIALS

by Z. D. Jastrzebski. 2nd ed., Wiley, NY (1976).

Reviewed by James L. White
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Most undergraduate chemical, mechanical, etc. engineering curricula contain courses in materials science. These are generally developments from early metallurgy courses in which the fundamentals of crystal structure, polymorphism, phase transformations and crystal deformation behavior has been introduced together with material on polymers and ceramics. At first the inclusion was token but has been increased through the years. This is, of course, reasonable in an age when the volume of polymers produced exceeds that of metals.

This book is typical of books of this type which aim towards a junior or sophomore level curriculum. A very wide range of topics are covered. It does have some excellent features not treated in much depth in most books of this type. The discussion of particulate matter and disperse systems is noteworthy. As with most books in this area, the treatment of material related to metals especially steel is much better done than that related to polymers and ceramics. Some of the contents of this and related books seem illogical. There is no discussion of refining metals from ores, but yet there is a full chapter on polymerization and a second on the chemistry of crosslinking. Certainly this is out of proportion. A major reason why books on materials science do not handle

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BOOK REVIEW: Waste-Water

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sional, graduate level, survey course. There are few undergraduate curricula or options in Sanitary and/or Environmental Engineering in the United States. However, for these it is relatively well suited. Teachers and students alike will recognize that this text is indeed an introduction and must be followed by further study or an apprenticeship in design before actual professional plant design can be contemplated. As a supplementary text for Chemical Engineering process or plant design courses the book is admirable.

The larger audiences may be in undergraduate Environmental Science and graduate Planning, Management Science, Urban Policy, etc. For these user groups, the text is too quantitative, lacking the descriptive material to place unit processes and overall treatment in proper overall community or industrial context. It may even create a false sense of intellectual security leading to attempts at independent design or design critiques that are controversial and counterproductive. In short, it lacks the clarity and comprehensive coverage that survey material aimed at managers and decision makers requires. If the author's goal is to "train the reader to evaluate any wastewater treatment problem so that he may properly select the processes and the design of the required equipment," he falls far short with the first audience and has an inappropriate goal with the second.

As an undergraduate engineering text, Professor Ramalho's book has some defects in detail. His references are outdated; the latest reference, that of Metcalf and Eddy (1972), should be one of the earliest. The last 5-10 years have been a period of great reorganization and reinterpretation of wastewater treatment technology. As a glaring example, there are no citations of USEPA manuals, yet many are good compendiums of design data and procedures. In addition, any design of consequence must meet the USEPA review criteria from which these manuals evolved. The AWWA, APWA, AWRA, AIChE, ASCE and other agencies concerned with "water" have excellent material available, also.

The use of a mixture of metric and English units is disconcerting. In most instances, there is unnecessary reliance on pounds for total loads and milligrams for concentration units. The letter M is used ubiquitously for million, as MGD, yet current metric usage of M for "kilo" and MM as the 10^6 multiplier notation is recognized widely. Rate constants on a per hour basis are not useful.

A discomfort and tentativeness with desirable depth of design detail is apparent in several chapters. I will use Chapters 3 and 5 as examples. Chapter 3 begins with a good elementary theory section, lacking only a clear distinction between settling and thickening. The real process design actually commences with the section on Flocculent Settling. This section, i.e. 3.5, devotes many pages to "cook book" procedure that is not direct or unambiguous, lacks adequate theory and uses language that places more emphasis on jargon than on clarity. Section 3.6 fails to draw distinctions between clarification and thickening and, similarly has little substance in an important design case study. Section 3.7 is of practical concern and is much too brief.

Chapter 5 requires rework for a second edition. It is a mixture of modeling, design and microbial ecology. It attempts too much and achieves too little. Why? Figure 5.1 and Table 5.1 are one reason. The number of variables stated is very large and of interest only to advanced modelers. This is an awesome introduction to activated sludge. The use of THOD as a design basis is questionable. The description of laboratory rate measurement experiments is best left to a graduate laboratory manual or kinetics text. There is too much jargon; is MLNVSS really necessary? An overconcern for detail in this chapter leads to cluttered displays, e.g. Figures 5.16 and 5.17, that serve to distract rather than to inform.

All-in-all, I am in sympathy with Professor Ramalho's effort and interests. However, the result has a narrow audience and does not compete with the Metcalf and Eddy text in conjunction with a set of USEPA manuals.

BOOK REVIEW: Engineering Materials

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plastics and rubber particularly well is that they spend too much space on synthetic chemistry. It would be better spent discussing solid state structure, crystalline morphology, mechanical properties and performance. If one can accept copper and steel without saying much of how they are made, can't we do the same for polyethylene?

In summary, this volume is a reasonably well done intermediate level undergraduate text in materials science. □