$X_A = 0.508$

$X_B = 0.253$

$X_C = 0.239$

The customer's assertion is correct ($\pm$ 5% deviation considered acceptable). □

ACKNOWLEDGMENTS

I would like to thank the students of my undergraduate course in thermodynamics of fall 1981 (University of Concepción) for having the courage to accept the challenge of first attacking the problem. Special thanks go to Mr. Jaime P. Morales, a good, perceptive student, for his useful contributions to my original problem statement.

ChE book reviews

PRINCIPLES OF POLYMERIZATION ENGINEERING

by J. A. Biesenberger and D. H. Sebastian
John Wiley & Sons, New York, 1983: $54.50

Reviewed by Donald G. Baird
Virginia Polytechnic Institute and State University

Chemical engineers are slowly being exposed to more polymer courses in their education. General courses in polymer science are most commonly available, but courses in polymer processing, materials, and chemistry are also being offered. One area of polymer engineering which should also be studied by chemical engineers and chemists is that of polymerization engineering. Some of the significant problems faced by scientists and engineers in the polymer industry are how to scale up reactors from the bench size, and how to design optimum and efficient polymerization processes. As we update the traditional engineering curriculum, it is important that a course in polymerization engineering be included. Of course, offering a course of this nature requires the availability of a textbook. In this article we review the text *Principles of Polymerization Engineering* by J. A. Biesenberger and D. H. Sebastian.

We first look at the goals of this book and its specific contents. This will be followed by a discussion of whether the authors reached their objectives. We will also discuss briefly the level of student for which the book is intended and critically evaluate it in terms of its pedagogical and scientific value.

The goal of the book, as stated by the authors, is to formulate generalizations that will be useful in the design, scaling, and modification of polymerization processes. To accomplish their goal, the authors start in Chapter One by defining the important concepts and terms needed in the remainder of the book. For example, the basic types of reactors and polymerization processes, along with the important variables, are discussed. The mathematical description of the reaction mechanisms and other pertinent relations are presented. In Chapter Two the kinetic variables (besides the monomer and initiator consumed) which affect the properties such as the degree of polymerization, the degree of polymerization distribution, degree of branching and its distribution, and copolymer composition and its distribution, are discussed. The main goal of this chapter is to mathematically incorporate the factors which affect the variables just mentioned, into the reaction kinetics.

Continued on page 91.

ChE letters

ANECDOTES ANYONE?

Dear Editor:

I should be pleased and grateful if you would kindly print this invitation . . . in an early issue of *CEE*. Many of your readers probably know of gems of chemical humor; I'd welcome your help and theirs in finding some.

For possible inclusion in an anthology, "Science with a Smile," I should welcome contributions of humor in the sciences: physics, chemistry, astronomy, mathematics, earth sciences, life sciences and computer science—historic and contemporary. Appropriate would be anecdotes, biographical notes, cartoons, parodies, verse, examples of self-deception, and hoaxes. I especially seek pieces which, while humorous, also have value in the history of science, providing insight into changing attitudes or illuminating personalities.

So far, chemistry is least well represented of the sciences in the manuscript for this anthology. I'd welcome evidence that chemists are not lacking in humor.

Please identify fully the sources of all contributions.

Robert L. Weber
104 Davey Laboratory
University Park, PA 16802

MASS TRANSFER TALKIN' BLUES

R. R. HUDGINS
Waterloo University

Performers' Note: These blues were performed at a pub with the author strumming an autoharp accompanying colleague-actor Carl Gall before a group of hapless Waterloo ChE students at their most vulnerable moment, i.e., just before exams. The dashes indicate points at which the performer would manage the "pregnant pause," which is the very essence of the talkin' blues.

Hackin' thru the courses—in Chemical E.—
On my way—to the bach'lors degree—
Learned a lotta stuff—'bout chemistry—
And somethin' called—Transport Phenomeny.

Prof calls it Mass Transfer—
Sure don't have much of a ring to it.

Ploddin' thru the textbook—in Unit Ops—
An everlastin' course—without a stop—
Got a load o' problems 'n' no solution—
Couldn't solve 'em without a—lotta collusion.

Anyhow, Prof said knowin' where to FIND the answer—
's a hesk of a lot more important than knowing—
How to DO it.

Sweatin' it out—until I drops—
But I'll never git the hang o' them—Unit Ops—
Gas Absorption, 'n'—Distillation—
Liquid Extraction 'n'—Humidification.

Prof uses a lotta big words in this course—
I used to think Transport Phenomena—
Was all about trucks.

Crunchin' out numbers on m' Texas Eight Four—
Leaves m' brain and m' fingers—just a little bit sore—
Hoped by now to be—pretty proficient—
But I still cain't do a—diffusion coeWcient.

Not too worried—
Long as none o' m' buddies figures it out—
Before the final.

Hittin' the textbooks—till two or three—
Doin' ev'ry problem in Three One Three—
Cain't help feeling—there oughta be—
A new mass transferless—Chemical E.

Human mind's too small for the like o' this—
Why cain't they crunch it up—
An' give it in smaller doses?

4. A. S. Rappas and J. P. Pemska, U.S. Patent No. 4, 148, 816, (1979).
5. M. A. Hugues, *Commercial Solvent Systems for Metals Extraction*, P. J. Bailes Ed., U.K., (1978).
6. F. A. Cotton and G. Wilkinson, *Advanced Inorganic Chemistry*, Wiley—Interscience, London (1972).
7. W. H. Morris, "Apparatus for contacting a liquid with a liquid or a particulate solid," U.K. Patent No. 885, 50, 3, (1961).

BOOK REVIEW: Polymerization

Continued from page 73.

Some of the theoretical treatment is compared with results for some polymerization processes of commercial importance, such as those for polystyrene and polyvinyl chloride. In Chapter Three the authors consider the effects of mixing on the reaction kinetics and the quality of product, while in Chapter Four thermal effects are discussed. In Chapter Five, the authors turn their attention to the coupling of flow and the extent of reaction. This material applies not only to continuous polymerization processes but to some of the newer processes such as reaction injection molding and reactive extrusion. Finally, in Chapter Six the process of removing residual small-molecule substances such as unreacted monomer or reaction products such as water is discussed. Additional background material is given in the appendices, such as polymerization chemistry, distribution theory, thermodynamics, and chemical kinetics. The last sections make the book nearly self-contained.

The book is primarily theoretical in its content. However, the mathematics and theory presented are well within the grasp of most senior chemical engineering students. The book could also be used

for first year graduate students. Most of the material could be covered in a one semester course but several topics would have to be eliminated if the text were used in a one quarter course. The text could also be adapted for use by chemistry graduate students by using chapters one through four.

Although the book is well written and the presentation is well organized, it has several shortcomings. From a pedagogical viewpoint, the lack of problem sets at the end of each chapter prevent the book from being a complete teaching aid. It would also be helpful if several case studies concerned with actual processes were analyzed and results were compared with data. This would serve the purpose of illustrating the use of the theory and at the same time show how good the theory is. Finally, it would be useful if the theories were analyzed critically so that one might know the limits of the theory and where one can expect deviations from the theory to occur.

In summary, the book is well written and one of the first textbooks covering the topic of polymerization engineering. Although there are several places where the book could be improved for teaching purposes, the overall quality and thoroughness of the theoretical coverage make the book a very good classroom aid. All we have to do now, as chemical engineering educators, is to realize that polymer science and engineering is not a topic of secondary importance (even falling behind the age old topic of distillation in many curriculums) but one of equal importance with all other topics in our curriculum. □

CATALYST MANUFACTURE: LABORATORY AND COMMERCIAL PREPARATIONS

by Alvin B. Stiles, edited by Heinz Heinemann
Marcel Dekker, Inc., New York, 1983;
192 pages, $49.75

Reviewed by Charles G. Hill, Jr.
University of Wisconsin

This monograph constitutes a useful addition to the literature dealing with heterogeneous catalysts. The author indicates that "Catalyst manufacture is probably the most secretive of all business enterprises." While this book exposes few, if any, industrial secrets, it does provide an excellent overview of the unit operations, procedures and equipment used in successful practice of the art of catalyst manufacture. Although developments in the past two decades have done much to more firmly establish the scientific basis of research in catalysis, our present state of knowledge still contains large voids where a fundamental understanding of the molecular processes involved in catalytic phenomena is lacking. Considerable progress has been made, and books and articles dealing with the general subject of *a priori* design of commercially viable catalysts have even appeared in the the literature (e.g. "Design of Industrial Catalysts" by D. L. Trimm). Nonetheless, many chemists and chemical engineers regard the development of commercial catalysts as the last bastion of alchemy. Stiles' discussions of several of the unit operations involved in the manufacture of industrial catalysts indicate that much art still remains. His emphasis is on how these catalysts are manufactured rather than on why certain techniques or materials are employed.

The monograph is divided into two portions; the first treats the several unit operations involved in various protocols for manufacturing heterogeneous catalysts while the second focuses on specific procedures employed in the manufacture of several industrially significant catalysts. The unit operations treated range from simple filtration and washing to calcination, pilling and spray drying. The brief discussions and the diagrams and pictures associated therewith would provide useful background material both to individuals beginning to work in the area of catalysis and to those professionals who work on the periphery thereof. The second half of the book provides detailed recipes for the synthesis of sixteen families of catalysts together with helpful hints for their production in a research laboratory environment (including some safety considerations). The generic catalysts discussed range from those used

ONE HUNDRED YEARS OF ACADEMIC CHEMICAL ENGINEERING (1898-1988)

In 1888, Professor Lewis Mills Norton established Chemical Engineering in MIT's Department of Chemistry. The Industrial Engineering Chemistry Division of the American Chemical Society will celebrate the 100th anniversary of this event with a major five-day symposium at the ACS meeting in Toronto, Canada, on June 5-11, 1988. There will be sessions on the "History of Academic Chemical Engineering," "Educational Development," and "Research in Universities." All chemical engineering departments are invited to participate in this joyous occasion by appropriate contributions. Please express your interest to participate, and offer assistance and ideas by writing to the Chairman of the Symposium, Professor Nicholas A. Peppas, School of Chemical Engineering, Purdue University, West Lafayette, IN 47907.