Amundson. The earlier version appeared in 1973 and is out of print. In the revision, Volume I covers single equations, while Volume II will cover systems of coupled equations.

First-order partial differential equations arise in chemical engineering largely as convective conservation laws. The principal applications in the book are chromatography and adsorption processes. Additional applications include heat exchange, pool boiling, chemical kinetics, reaction engineering, water flooding of petroleum reservoirs, propagation of sound waves, and sedimentation. A substantial amount of material has been added in revision on countercurrent adsorption in moving beds and traffic flow.

Volume I covers material presented in the first seven out of nine chapters of the earlier version; originally, 267 pages, now the treatment has been expanded to roughly twice that number. The presentation has been considerably reorganized. While little of the earlier version has been left out, the material added is nicely balanced between broad treatment of applications and thorough explanations of theory. The expanded treatment in the central chapters in particular is an improvement over the previous version.

The approach adopted in the book is to classify equations by type and present methods appropriate for the solution of the various types. The coverage is comprehensive. Especially detailed treatment is given of the homogeneous quasilinear equation with considerable discussion of simple waves and the formation and propagation of shocks.

In the preface, the authors express their hope that the book will be used in applied mathematics course offerings for first-year graduate students. Indeed it should be for several reasons. The subject is an important one. The book contains a number of exercises, many of which were added to the revision. Throughout the book, particularly, the early and central chapters where the main ideas are presented, the treatment is easy to follow. The authors tie together engineering literature and more formal mathematical literature. Referencing is thorough and up-to-date. For many of these same reasons the authors deserve the thanks of researchers active in the areas of application.

M. D. LeVan
Department of Chemical Engineering
University of Virginia
Charlottesville, VA 22901

Plastics Technology Handbook

By M. Chanda, and S. K. Roy, Marcel Dekker Inc., New York, NY, 568 pp., 1987, $99.75.

This book is divided into the following four sections and contains six appendices.

Section 1: Characteristics of Polymers. It deals with their definitions and concepts.

Section 2: Fabrication processes. Discussed in this section are the major polymer conversion processes.

Section 3: Plastics Properties and Testing. Various properties and the testing methods of plastics are described.

Section 4: Industrial polymers. This main section is divided in three parts to focus on the chemical structure, synthesis, and typical applications.

1. Addition Polymers: polyolefins, olefin copolymers, acrylics, vinyl polymers

2. Condensation Polymers: polyesters, polyamides, formaldehyde resins, polyurethanes, ether polymers, cellulosic polymers

3. Special Polymers: heat resistant polymers, silicones and other inorganic polymers, functional polymers

In light of the increasing trend of new books toward specialization and theoretical aspects of polymer science and engineering in recent years, it is comforting to see a book which is broad in contents and basic in level of treatment.

As the press release by the publishers states, this book could be appealing to various readers—from plastics, mechanical and chemical engineers, to colloid, oil and color chemists, as well as materials scientists and students (both undergraduates and graduates) taking courses in plastics and polymers. Many will find the section dealing with electrical and optical properties quite valuable, while others will find the treatment of the micromechanics of reinforced plastics well structured and educational. The main section describing industrial polymers contains a wide range of useful information on new polymers, particularly the specialty polymers. Extremely useful for those involved in selection and use of polymers is Appendix 1 which lists trade names and manufacturers for polymers available commercially, and Appendix II which lists typical properties.

There are, however, a number of shortcomings varying from superficialities and inconsistencies to fundamental inadequacies. While one may tolerate the "minestrone" approach to the use of units for polymer properties and processing parameters, there can be no excuse for dismissing "extruder capacity" with a half page treatment which includes two unfamiliar and simplistic empirical equations. Very little attention has been given to additives, and plasticisers are discussed primarily in terms of solubility parameters and what characteristics they should possess, without discussing how they affect properties.

Leno Mascia
Institute of Polymer Technology
and Materials Engineering
Loughborough University of Technology
Loughborough LE11 3TU, England

High Resolution NMR Spectroscopy of Synthetic Polymers in Bulk

By Richard A. Komoroski, Ed., VCH Publishers, Inc., Deerfield Beach, FL, 379 pp., 1986, $75.00

The past twenty years have witnessed the development of techniques for high-resolution nuclear magnetic resonance spectroscopy of rigid solids. This book is the first dedicated compendium of applications of these techniques to synthetic polymers. The book is intended to serve both as a summary of work published to date and as a guide for further research. It was written primarily for polymer scientists who have some familiarity with NMR and an interest in applying high-resolution techniques to bulk systems. For such an audience, most of the book should be readily understandable. The text is organized by topics in polymer science, which emphasizes the wide range of applicability of the techniques to this field. Mathematical justification for the spectroscopic methods is limited. Instead, specific examples drawn from the polymer literature are presented and discussed in detail.

The first chapter of the book provides an overview of potential applications of high-resolution NMR methods to solid polymers, introducing many of the topics to be dealt with later and mentioning other areas such as imaging, bipolymers, and surfaces. Chapter 2 summarizes the line-narrowing and sensitivity-enhancement techniques used for recording high-resolution spectra of dilute spins in solids. These include magic-angle spinning, high-power decoupling, and cross polarization. The next three chapters deal with applications of these methods to glassy

amorphous polymers, to polymers analyzed above their glass-transition temperatures, and to semicrystalline polymers. The final five chapters discuss special topics, including the study of polymer conformations, chain dynamics, orientation, and morphology.

The book has a number of attractive features. Foremost among these is its thoroughness in reviewing published work and the range of subjects covered. Several hundred references have been provided by the authors of the individual chapters. Most classes of polymer systems are discussed in detail: elastomers, glasses, semicrystalline polymers, and oriented materials. Separate treatment of these classes is useful, since both the applied spectroscopic techniques and the resultant information can vary substantially among the different systems.

With regard to the NMR methods, the final two chapters of the book, dealing with proton multiple-pulse spectroscopy and deuterium wideline studies, broaden the scope beyond the carbon-13 investigations. These two areas will be less familiar to many readers, but they can be uniquely informative with respect to polymer morphology and mobility. Another attractive aspect of the book is that the chapters can be read independently. One who is interested primarily in the study of amorphous elastomers can proceed directly to that section of the book without penalty. Despite this independence, the chapters have been cross-referenced well, and relevant figures and discussions which appear in different chapters are identified.

The book's primary deficiency is a shortage of practical information concerning the experiments. A number of specific points come to mind. First, for one without experience in solid-state NMR, it may be difficult to extract the instrumental requirements for studying each class of polymer system. A brief section concerning such requirements would be a welcome addition to several of the chapters. (The deuterium NMR chapter has a section dealing with aspects of both hardware and software.) Second, since quantitative data are required for many applications, an explicit section on this subject would also be useful. Information concerning quantitative results is scattered throughout the chapters, but there is no concise discussion of how to record quantitative spectra with both cross polarization and single-pulse excitation. Temperature and contact time should be emphasized as useful parameters in quantifying results. Third, with the increasing ubiquity of high-field spectrometers, further experimental details concerning both the elimination and the exploitation of spinning sidebands would be helpful. Finally, a brief section dealing with carbon-13 spin diffusion would highlight an important, but sometimes overlooked, feature of many of the NMR experiments conducted on rigid solids.

For scientists interested in characterizing the behavior of bulk polymers, this book is recommended reading. The versatility of the high-resolution techniques will quickly become apparent, and the reader is likely to recognize areas in his own research or development where the NMR techniques would prove useful. Both academic and industrial scientists should gain an appreciation for information available through solid-state NMR which is difficult to obtain by other means—e.g., structural analysis of thermosets, site-specific motional information, and noncrystalline chain orientation. The book would also serve admirably as the text for a special topics course in graduate school. The structure of the book makes it amenable to a wide range of courses, since most of the chapters can stand alone and since the writing style throughout the chapters is uniformly clear.

John Havens
Raychem Corporation
300 Constitution Drive
Menlo Park, CA 94025

Corrosion Mechanisms

By Florian Mansfeld, Marcel Dekker, Inc., 1987, 455 pp., $89.75

This book discusses mechanisms that have been proposed for major categories of corrosion phenomena. Because the authors present the pros and cons of various competing mechanisms, the volume succeeds in providing an excellent summary in this area. Amply referenced, the nine chapters contain 841 citations, 20% of which are from papers published in the 1980s. While the more recent scientific advances are included, the book serves mainly as a tutorial for readers who are interested in the corrosion field with a modest background in physics, chemistry, materials science, or engineering.

Each of the nine chapters is written by well-known experts. Topics include dissolution of pure metals (Fe, Co, Ni) and alloys, corrosion inhibition, coatings, atmospheric corrosion, pitting corrosion, effect of hydrogen on metals, corrosion fatigue, and high-temperature oxidation. Each of these topics has a long history of past research, much of which consists of case studies and attempts at identifying key parameters by observing phenomena. Corrosion is an old problem but a relatively young field of science. The way the literature of the field is indexed in this volume indicates that there has been the transition from case studies (reporting of diverse observations) to underlying fundamental phenomena (thermodynamic, kinetic, or transport behavior). Such transformation will, in due time, make it increasingly easy for scientists and engineers having specialized training to enter the corrosion field and make useful contributions. The chapters on dissolution of pure metals and localized (pitting) corrosion are particularly strong in this respect.

Most corrosion processes are of an electrochemical nature. The phenomena include events in the metal phase, at the interface, in surface films, and in the electrolyte phase. In such systems it is difficult to carry out controlled experiments, to vary parameters one by one, or to make experimental observations at high resolution of chemical or spatial detail. Therefore, a critical evaluation of mechanisms as presented here represents a significant contribution. In many types of corrosion, the behavior of surface films is critical. In those cases where detailed experiments are described, it is evident that the local chemical environment is the critical factor that influences the properties of the surface film. Thus the volume provides a stimulating list of research opportunities: in probing surface chemistry at liquid-solid surfaces; for studying transport and reaction to interfaces and within surface films; and for developing mathematical models for predicting behavior. For these reasons, the book deserves careful attention by the chemical engineering community.

The topics are covered well. Two important areas not treated are stress corrosion cracking (and its close neighbor, crevice corrosion), and velocity-dependent phenomena (such as erosion, cavitation, and impingement corrosion). While some chapters touch on these areas (corrosion fatigue and hydrogen embrittlement), their emphasis is more on the metal-phase phenomena, such as dislocations and fracture mechanics, than on the entire interfacial region. The shortcomings of the