

book reviews

Rubber Processing and Production Organisation

Philip K. Freakley

Plenum Publishing

Corporation (New York),

US \$59.50,

ISBN 0-306-41745-6

The technology of rubber processing has been poorly served by the literature; what texts are available are generally at an outline descriptive level. However, this book goes well beyond such levels by invoking the systems approach to manufacturing technology, which is achieved first by analysing the processes involved and then by synthesizing the elements in such a way that it 'fully exploits all the advantages to be gained from them'.

The first analytical chapters are concerned with such topics as material behaviour and testing, principles of mixing, extrusion, calendaring, heat transfer, moulding, process control and quality control. These are followed by chapters on plant layout, operations methods, company philosophy, organization strategy, manufacturing economics and production management. Throughout the text the role of the microprocessor and the computer as a manufacturing aid is clearly delineated.

Fortunately, I am familiar with much of the content of the earlier chapters and can confirm the accuracy of the facts given. However, for a newcomer I believe that these chapters would be rather hard going. Terms such as 'scorching' and 'exponential mixing' are introduced without proper explanation. More disconcertingly, equations are produced without the meanings of the symbols always being given (such as equation 6.14 on p. 138). Even where symbols are given, the equations are rather thrown at the reader, who might find them indigestible. I must also admit that I found some of the more qualitative explanations rather difficult to follow.

In fairness, however, to the author, he does not say it is for newcomers but that the 'primary aim of the book is to provide technical, engineering and management staff in rubber product manufacturing companies with a detailed and practical guide to manufacturing systems'. To such people this book should provide a stimulus and, with the aid of the references given, enable them to realize the possibilities available to them.

J. A. Brydson

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Alternating Copolymers

J. M. G. Cowie (Ed.)

Plenum (New York), £45.13,

US \$47.50,

ISBN 0-306-41779-0

Highly alternating copolymers have been the subject of intense academic interest since the mid-1960s, with peak interest being shown around the mid-1970s. Recently the pace of work has slackened somewhat, so a 'stock-taking' review of the whole area is particularly timely. As far as I am aware, Professor Cowie's book represents the first such attempt at a comprehensive review of the various mechanisms for the production of alternating copolymers, although there have been many reviews of selected aspects in the past.

The book opens with a general chapter by Cowie, which discusses the factors that control monomer reactivity, provides a definition of alternating copolymers, and then very briefly outlines the main mechanisms by which such copolymers can be formed, namely copolymerization of donor with acceptor monomers, copolymerization in the presence of Lewis acids, through use of Ziegler-Natta catalysts and, finally, via zwitterion intermediates.

The chapters following this introduction are devoted to each of these important methods. In the first of these, Cowie reviews radical copolymerizations of donor with acceptor monomers with, as expected, particular emphasis being placed on the evidence for the involvement of monomer-monomer donor-acceptor complexes in propagation. Also, as would be expected, much of the chapter is devoted to discussions of systems involving maleic anhydride. Any chapter on an area as large as this has to be very selective as to the material and topics that are to be covered, and Cowie's choices here are beyond reproach.

The next three chapters are all written by acknowledged experts on their subjects: Bamford on copolymerizations in the presence of Lewis acids; Furukawa (with Maruyama) on Ziegler-Natta catalysed copolymerizations; and Saegusa (with Kobayashi) on zwitterionic copolymerization. All three chapters are good and Bamford's is particularly impressive. Reviewing the work on copolymerizations involving Lewis acids is a monumental undertaking and requires a great deal of care to be exercised in sifting good work from bad and misleading evidence from enlightening. Professor Bamford's own careful

work has shown that many of the features of alternating copolymerizations in the presence of Lewis acids can be explained in terms of conventional copolymerization concepts; this work is covered in the chapter but, in addition, new interpretations are provided for much other work covering a variety of systems and conditions, and at last there emerges a coherent picture of what, in the past, has seemed a very confused area.

Most interesting in alternating copolymers has centred around mechanisms for their production and the overall balance of the book, with most of the chapters devoted to discussion of mechanisms, reflects this. However, the book concludes with a chapter on physical properties of alternating copolymers (McEwen and Johnson). The impression one gets from reading this chapter (undoubtedly correct) is that relatively little has been done to explore in any systematic way the properties of alternating copolymers, and, in consequence, the uses to which such copolymers have been put, as yet, are few. This is clearly an area where more needs to be done, as McEwen and Johnson have recognized.

Overall this is a very satisfactory volume: comprehensive, authoritative, up-to-date (references in the main to 1983), eminently readable and of a uniformly high standard. My only complaint is that the price of the book will deter many from buying it; like so many volumes from American publishers the price in the UK seems too high by comparison with the price in the USA.

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Polymer Science and Technology, Vol. 26:

Polymer Additives

J. E. Kresta (Ed.)

Plenum Press (New York),

US \$72.50, £68.88,

ISBN 0-306-41807-X

This book is based on papers given at an American Chemical Society Meeting on Polymer Additives in 1982 and the main topics covered are u.v. degradation and stabilization, thermal oxidation and stabilization, flame retardance, plasticizers and reinforcing agents. There is almost certainly something of interest to anyone concerned with polymer additives since it covers a very broad spectrum of polymer science and technology. Like all symposium proceedings, the papers range in quality and content from the empirical,

thinly disguised advertising by polymer additive manufacturers, to critical and often polemical discussion of mechanisms.

In the reviewer's opinion, the latter make the most significant contribution to the advancement of the subject, even though the contents of some of the review papers are already dated in the light of more recent research. On the more fundamental aspects of the subject, the following are timely: Carlsson and co-workers on hindered-amines light stabilizers; Shlyapnikov on critical-concentration phenomena; Kuck on antioxidant stability; Arey and co-workers and Guyot and co-workers on PVC stabilization; Moore and Stanes and their co-workers on molybdenum smoke suppressants in PVC combustion; and Park and co-workers on the mechanism of plasticizer diffusion in PVC. Among the more empirical papers there are interesting reports on the photostabilization of polyurethanes (Ozawa *et al.*), on the photografting of azodyes into polymer surfaces (Bellobino *et al.*) and in the use of titanate coupling agents (Monte *et al.*).

Like most compilations of conference papers, this book suffers from the problem of repetitiveness, particularly in section 1 (u.v. stabilization) where, for example, the mechanism of the hindered piperidine light stabilizers is discussed at length on four occasions. It is interesting to speculate whether the prohibitively high cost of the book to the personal collector might have been reduced considerably by appropriate editing or by more careful selection of conference speakers to avoid repetition in the first place.

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Polymer Degradation and Stabilization

N. Grassie and G. Scott

Cambridge University Press,
£27.50, ISBN 0-521-24961-9

The wide technological importance of polymer degradation and the scientific challenge to understand its chemistry

have not prevented the subject being something of a Cinderella of polymer science for many years. This is reflected in its superficial treatment in, or exclusion from, most text books. In the present book the authors have set out to remedy the deficiency by providing a survey of all of the major degradation reactions of polymers, and of the methods used for preventing them, at a level aimed at the student rather than the researcher.

After a brief general introduction there are six major chapters. A very substantial one describes the thermal degradation of polymers, copolymers and blends in the absence of oxygen and is followed by a shorter description of the photo-degradative effects of 254 nm u.v. radiation. Two major chapters discuss the chemistry of oxidative degradation and the reactions of stabilizers. Fire hazards and fire retarders have a chapter to themselves and the book is completed by a section covering miscellaneous effects, such as high-energy radiation, stress, atmospheric pollutants and hydrolysis. Throughout the book the reader is led gently to the frontiers of the subject. Experts may see an occasional assertion as contentious, but this is inevitable in a short book that covers so much, in a field that is still expanding.

The authors have both made very substantial contributions to their complementary fields and the book is thoroughly authoritative and up-to-date. The chapter on antioxidants is particularly welcome, since stabilizer chemistry has been developing very rapidly in the last few years. The approach usefully emphasizes descriptive chemistry; there is little discussion of kinetics, a subject well covered elsewhere, and only very limited description of experimental methods. Somewhat surprisingly, there is virtually no discussion of biodegradation or developments in biodegradable polymers.

The book is well produced and achieves its stated aims very well. It should be of interest to anyone looking for a reliable overview of the field and it is to be hoped that its availability will lead to a greater consideration of the subject in polymer courses.

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Engineering Thermoplastics: Properties and Applications

Ed. James M. Margolis

Marcel Dekker Inc. (New York),
\$65.00 (Domestic), \$78.00
(Foreign),
ISBN 0-8247-7294-6

This work classically exhibits both the advantages and the disadvantages of an edited book: the main advantage is that the writers can speak with authority on their subject matter and give up-to-date information; the main disadvantage is that there is an inconsistency of treatment, with some contributors discussing the scientific background, with many references to the literature, whilst others provide little more than trade literature on properties, processing and applications. That all of the contributors, with the exception of the editor, came from manufacturing companies, had an overall neutral effect since, although contributors seemed to feel free to promote the product of their companies, the fact that contributions came from such a wide range of companies largely eliminated bias; even so, not all of the leading engineering plastics suppliers are represented. With such a work it is unreasonable to expect any critical comparison of the materials reviewed, and none was given.

Altogether, some 15 classes of engineering thermoplastics are covered, including recent additions such as poly(ether-ether-ketone), polyarylates and the poly(ether-imides). One notable omission, in my opinion, was that of fluorine-containing plastics: their absence led me to attempt a check on how the editor defined engineering plastics, which provided the title of the book, but I could find no attempt to make such a definition. This rather reinforced the view that the work is largely a compilation of papers rather than an integrated treatment. Nevertheless, there is much useful information provided and it should prove a valuable source of reference.

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