

# Book Reviews

## Flame Retardancy of Polymeric Materials

*Edited by W. C. Kuryla and A. J. Papa*

Pp. ix + 183, New York, Marcel Dekker, Inc. 1978, Price 62 Sw.Frcs

The three previous volumes in this series contain mainly chapters dealing with the fire-retardancy of particular classes of polymers. The present volume goes some way to restoring the balance between general and non-specific topics as a result of the inclusion of two further broadly-based chapters on flame retardancy in polymers, both written by acknowledged experts in their respective fields.

The first chapter, by R. R. Hindersinn and G. T. Witschard, is entitled 'The importance of intumescence and char in polymer fire retardance'. In fact, after a short introduction outlining the contribution of polymeric materials to current fire losses, a description is given of some of the more important flammability test methods. A concise but useful account of polymer combustion is then followed by a summary of the principal methods at present used to reduce the flammability of polymeric materials, and by a more detailed description of the uses and limitations of several classes of flame retardants. It is only in the following and final section (about 12 pages long!) that the authors start to deal with intumescent coatings and char formation. This is certainly a useful account of the subject but one is left with the impression that far too little fundamental work has yet been done on this aspect of the flame retardance of polymers.

D. L. Chamberlain is the author of the second, somewhat shorter but more accurately titled chapter, 'Mechanisms of fire retardance in polymers'. This is a fairly general, well-balanced, account of the different ways in which flame retardants can act. After a short historical introduction, there is a clear, though brief, section outlining the principal stages involved in the burning of polymeric materials. This is followed by a longer section entitled 'Fire Retardance in Principle' which describes the possible ways of altering the production of flammable gases from polymers and the subsequent ignition of these gases. In the final section entitled 'Fire Retardance in Practice', which occupies over three-quarters of the chapter, useful accounts are given of synergism, and of fire retardants affecting polymer decomposition and both gas-phase and smouldering combustion.

Both chapters are, in the main, carefully written and well organized and contain much information of interest to all those concerned with the flame retardance of polymers. It is sad to record, however, that in a book appearing at the end of 1978, there are only two literature references (out of a total of over 250) later than 1975! There are many

minor errors which the reviewer would like to attribute at least partly to the fact that traditional printing methods have not been used for the production of this book and that, in consequence, the final version has not been subjected to proper editorial scrutiny. There is, for example, considerable inconsistency, with regard to the presentation of the literature references. Thus, authors are referred to in the text sometimes simply by their surname (e.g. Stuetz on pp. 14, 24 and 29) and sometimes by their surname and initials (e.g. D. E. Stuetz on pp. 35 and 37); and on p. 44 appears the strange name of D. W. van Krevelen Krevelen! Similarly, in the references, some authors are given Christian names and some only initials, e.g. J. W. Lyons and John W. Lyons, both on p. 162. Then we find Eichorn on pp. 121 and 144, but Eichhorn in the reference list (p. 159) and author index (p. 170)! It appears to be entirely arbitrary too whether the first page number alone or both the first and last page numbers are given in the literature references. Errors and inconsistencies of this kind should not appear in profusion. This has helped to spoil the final good impression which this book should have given.

C. F. Cullis

## Polymerisation Processes

*Editors: C. E. Schildknecht with I. Skeist*

John Wiley & Sons, New York, 1977, pp 768, £27.00

This is the 29th volume in a series of monographs on high polymers. Separate authors have written the nineteen chapters and each chapter deals with one particular aspect of polymerization. In some cases, attention is focussed on a particular polymer type and the discussion is concerned with the various chemical reactions and processes which are used to make the materials in question. Other chapters deal primarily with a particular reaction mechanism and use the polymerization of various monomers to illustrate the use of this mechanism.

Although the book is dominated (quite naturally) by the basic chemistry of polymerization, there are many descriptions of the industrial equipment which is used in large-scale processes. Some authors have emphasized the developments that have occurred in recent years; others have written more general accounts complete with historical surveys. The chapters are largely self-contained but they vary markedly in tenor and depth of treatment. Some chapters present their subject matter in a fairly rigorous quantitative manner, whereas others are largely catalogues of recipes.

Much of the book would only be appreciated by those who are already familiar with polymerization. There are some introductory sections but these would be insufficient for the reader with no previous knowledge of the subject. (The basic terms are not always defined and some of the discussions would confuse the novice).

In some cases, specialists would find fuller accounts of their subjects in other books. Even so, many of these books are now out of date and this new volume contains many references to the most recent developments in polymerization. The book will be of use to many workers in the polymer industry. Inevitably, individual purchasers will find that they do not have an equal professional interest in all nineteen chapters. However, they will also find some sections which are not covered in other textbooks.

B. W. Brooks

## Applications of Polymer Spectroscopy

*Edited by E. G. Brame*

Academic Press, New York, 1978, pp. 289, \$29.50

The idea for this book originated during a symposium organized at a recent National American Chemical Society meeting in San Francisco to discuss some of the newer spectroscopic techniques being applied to the characterization of polymers and polymer structure, and it is based on material presented at the symposium. It consists of sixteen individual chapters, varying in length from 5 to 33 pages. Approximately one third of the book is devoted to n.m.r. ( $^1\text{H}$ ,  $^{13}\text{C}$  and  $^{19}\text{F}$ ) and slightly less to each of vibrational spectroscopy (Raman and i.r.) and mass spectroscopy. There is also one chapter on a study of the autoxidation of *cis*-1,4-polyisoprene using chemiluminescence and one chapter concerned with the application of e.s.r. to studies of polymer deformation and fracture.

Most of the n.m.r. chapters are essentially conventional research papers which would more usually be presented in journals or in a straightforward 'symposium proceedings' publication which, according to the preface, this book is not, by virtue of some updating of the material subsequent to the symposium. They are concerned with the microstructure of polyperfluorobutadiene, polyalkenamers, ethylene-carbon monoxide copolymers and ethylene-ethyl acrylate-carbon monoxide terpolymers and with the thermal oxidation of *cis*-1,4-polybutadiene and the photosensitized oxidation of polyisoprene. There is

only one chapter of a different nature, viz. a review of  $^{13}\text{C}$  relaxation studies of bulk polymers (mainly by the author) which demonstrates both the potential of this kind of study and the difficulties of interpretation involved.

The chapters of vibrational spectroscopy are in general of the nature of reviews except for a short one on studies of  $\gamma$ -aminopropyltriethoxysilane adsorbed on bulk iron. They cover the applications of Raman spectroscopy to biopolymers, of Fourier transform (FT) i.r. spectroscopy both to optically dense materials such as coal, and to synthetic polymers which are usually optically less dense materials. In these latter studies it is really the computer (necessarily attached to a FT instrument, rather than the FT technique itself, which is shown to be a useful tool for manipulating spectra). As admitted by the authors, most of the manipulations could be done using a conventional spectrophotometer and a separate computer, though perhaps less conveniently. One chapter is devoted to dynamic infrared studies of synthetic polymers. The mass spectroscopic studies described are concerned with thermal and mechanical degradation and combustion of polymers and the characterization of the products.

The book is well produced and contains much interesting and stimulating material on a wide variety of experimental techniques applied to a very wide range of types of polymer system.

D. I. Bower

## Developments in Chromatography - 1

Edited by C. E. H. Knapman  
Applied Science Publishers Ltd.,  
1978, pp 245

Chromatographic techniques have been studied actively in recent years, and a review of the significant developments is most welcome. There are now so many forms of chromatography which are used widely as analytical and preparative techniques in all branches of chemistry that only a limited number of the more important developments can be selected for critical review in a volume of just over 200 pages. The range of chromatographic techniques is well illustrated by the chapter on 'Chromatography in Forensic Science' by R. N. Smith who describes many procedures and applications. This chapter does degenerate into a catalogue of references in places and the reader can only refer to the original papers for details.

In view of the breadth of chromatography today, this reviewer with interests in the chemistry of synthetic polymers was pleasantly surprised to find two chapters directly relevant to polymer characterization. The chapter on 'Polymer Molecular Weight Distribution by Gel Permeation Chromatography' by Hatt is a more general review than the title suggests. The author reviews the theories of the g.p.c. mechanism, calibration, resolution, and practical aspects in detail, but the problem of chromatographic inter-

pretation is described briefly. The comprehensive table on column packings is particularly useful. The chapter on 'Developments in Continuous Chromatographic Refining' by Barker indicates how preparative polymer fractionation may be performed by alternative methods to the direct scale-up of analytical procedures. Continuous processes utilize more of the column, and countercurrent, crosscurrent and cocurrent flow processes are reviewed from a chemical engineering viewpoint. Results for several separations of polymers by a g.p.c. mechanism are described.

The remaining three chapters are more appropriate to chemists characterizing low molecular weight additives in polymers by gas chromatography. The chapter by Vernon covers the thermodynamic aspects of solute-solvent interactions for liquid stationary phases. This chapter is restricted to low molecular weight liquids or low polymers as stationary phases, and a discussion of high polymer stationary phases is omitted. The procedures for the separation of isomers described by Sharples will be of interest to those involved with identifying chemically similar additives in polymers. Finally, the experimental operation and scope of a range of detectors are covered in a chapter by Grant.

In summary, this volume, which contains many references to papers published in 1977, should be acquired by a library serving a laboratory interested in chromatographic separations.

J. V. Dawkins

# The Blackie Publishing Group

## Polymers

Chemistry and Physics of Modern Materials

J.M. Cowie, *University of Stirling*

298pp ISBN 0 7002 0222 6 £5.95 net (U.K.)

This successful textbook offers the undergraduate a complete picture of the science of polymers. Emphasising the interdisciplinary nature of polymers, the author develops the subject through the sequence of preparation, characterization, physical and mechanical properties, and structure-property relations. In short, an ideal introductory text for the chemistry or physics student.

*"... an excellent book which will fill a very real need... the best textbook currently available at this level."*

Chemistry in Britain

*"The author has struck a nice balance between the introductory, the academic, and the practical. I doubt whether anyone grappling with polymers for the first time could do better, as a preparation, than to read this book."*

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