

Synthesis and Separations using Functional Polymers

D. C. Sherrington and P. Hodge (Eds.)

John Wiley & Sons Limited, Chichester, 1988, x+454 pages, £52.50
ISBN 0-47191-848-2

Ten years ago the use of polymers as supports for organic reactions could be regarded as an exciting new development. Today the subject remains exciting but there is now an extensive literature and regular symposia in the field and an important technology based on the use of polymer supports. The same authors provided a useful review volume, 'Polymer-Supported Reactions in Organic Synthesis', in 1980 and the present book is to be regarded as a sequel, both updating topics previously considered and introducing new topics. The contributors are all distinguished researchers in the particular application of functional polymers which they discuss.

In the opening chapter, Guyot considers the synthesis and structure of polymer support, concentrating mainly on styrene-based polymers and on control of important parameters which determine behaviour. The second chapter (Hodge) is the longest in the book and considers organic reactions using polymer-supported catalysts, reagents or substrates. A broad general view of the whole area is given, in which some recent advances are highlighted. The remaining chapters are shorter and (apart from the last) more sharply focused on specific aspects. Carron and Gates examine polymer-bound transition metal complex catalysts. Widdecke discusses design and industrial application of polymeric acid catalysts, with the emphasis on polystyrene sulphonic acid resins. Tomoi and Ford contribute a chapter on polymeric phase transfer catalysts, i.e. materials which catalyse reaction between immiscible reactants by transfer of one of the reactants at the interface. Neckers discusses properties of polymeric Rose Bengals—polymers as photochemical reagents. Such a material acts as an immobilized photosensitizer and has a particular use for the preparation of single oxygen. Van den Berg and Challa deal with enzyme-like polymers and Jervis considers polymers in affinity chromatography, used as a protein purification technique. Pickle and Mahler discuss chiral polymers in separation of enantiomers and Warshawsky presents a chapter on polymeric ligands in hydrometallurgy. In the final chapter,

Sherrington presents a wider perspective of polymer supports and reactive polymers.

This attractively set book is informative and stimulating and can confidently be recommended to polymer chemists and others who wish to keep abreast of developments in a fascinating area of polymer chemistry.

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Electrical and Electronic Properties of Polymers. A state-of-the-art compendium

J. I. Kroschwitz (Ed.)

John Wiley & Sons Limited, Chichester, 1988, xxvi+330 pages, £38.95
ISBN 0-47160-896-3

The size and cost of Wiley's Encyclopedia of Polymer Science and Engineering precludes it from the bookshelf of the average scientist or engineer. And so it is to be found mainly in the reference section of larger libraries. The breadth and depth of coverage encompassed by the encyclopedia means that particular groups of articles are consulted by individuals selectively according to specialization. The publishers have recognized this and have brought together articles concerned with particular areas of widespread interest. One such area is electrical and electronic properties of polymers.

The book comprises 10 chapters by expert authors. Five of these chapters are substantial contributions of 40 pages or more. The authors have adopted a common approach lying between textbook and academic review. Each contribution begins with an overview of fundamental principles leading to a review of recent discoveries, inventions and techniques, finishing with a comprehensive bibliography. The mixture succeeded, allowing me to grasp some advanced, unfamiliar topics with relative ease. The process was helped by the absence of mathematics, the general thrust being conceptual.

The book divides into three parts of approximately equal length. There are three chapters devoted to the electrical and electronic characteristics and applications of polymers, three to their optical properties and uses and four to electroactive polymers.

The three chapters dealing with electrical characteristics begin with a comprehensive outline of the electrical

properties of polymers. Theoretical aspects are dealt with efficiently followed by an outline of the standard tests used in the characterization of electrical behaviour. The breakdown and degradation of polymers in high fields is dealt with in a refreshingly practical but not trivial manner. Tracking, discharge erosion, electrical and water treeing and thermal ageing are all admirably described and explained. Whilst these topics are inclined to high power applications aspects closer electronic interests are dealt with equally effectively. There is comprehensive coverage of high frequency, a.c. characteristics with particular regard to loss factor. Less attention is given to static electrification which is surprising considering the principal role played by polymers in its generation and the damage it does to modern high impedance circuits. The chapters concerned with electrical aspects are completed by applications orientated sections which describe how conducting polymers can be used to suppress e.m. radiation and the use of polymers as encapsulants, adhesives and tapes. Much of the information provided on these latter topics is remarkable for its blandness and is obtainable in any respectable electronics catalogue.

Electroactivity occurs in polymers with conjugated π -electron backbones. Two of the most interesting are polyacetylene and diacetylene polymer. Their synthesis and chemistry are described in two chapters whilst the physics and chemistry of electrically conducting and photoconducting polymers are described in a further two chapters. By virtue of its commercial pre-eminence polyacetylene features prominently in explaining conducting polymers but not at the expense of less exotic, composite polymeric conductors. Photoconductivity is dealt with in less detail.

Polymers play an important part in optical technology as recognized by the three chapters devoted to it. They have been used for many years in the lithographic reproduction of macro and micro circuits; the techniques of both are described. The birefringence effects exhibited by polymers are reviewed over two chapters where their application to the measurement of strain and modulation of coherent light are duly considered. So too are exciting developments in the use of polymers for the optical storage of data. But these modernistic applications are not allowed to overshadow the important applications of polymers in the production of refractive articles.

In summary, the book achieves its aim of providing a valuable advanced reference source. It contains chemistry useful

to the engineer and engineering useful to the chemist. This crossing of boundaries is achieved with great ease and is the book's unique asset.

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Degradation and Stabilization of Vinyl Chloride-Based Polymers

K. S. Minsker, S. V. Kolesov and G. E. Zaikov

B. L. Kazushin (Translator)
T. R. Crompton (Ed.)

Pergamon Press, Oxford, 1988,
xviii + 508 pages, £125.00
ISBN 0-08-034857-2

This book, unlike others in the area of polyvinyl chloride degradation not only represents a more comprehensive approach to the subject but is a Russian translation and therefore provides a valuable insight into many important works in Eastern Europe that may have been previously unattainable because of the language barrier. Its aim is to provide, in some organized form, a collation of most of the available knowledge in the field and discuss the problems involved as well as the various methodologies. The authors have carried out this task in a well-written, well-planned, critical and highly presentable manner and leave few stones unturned. Whilst some of the information contained in the book is covered elsewhere it nevertheless provides a complete forum on the subject, and in this respect, is an extremely valuable text.

The book is made up of a total of 12 chapters beginning with the structure and composition of vinyl chloride-based polymers. The next chapter deals with the degradation of these polymers while the third covers aspects of the chemical stability of PVC. The fourth chapter covers the fundamental stability of vinyl chloride-based polymers with particular emphasis on improving macromolecular stability with Chapter 5 covering the more general aspects of the stabilisation of vinyl chloride polymers. The stability of vinyl chloride polymers to radiation is covered next in Chapter 6 while more specialized treatments for improving stabilisation are covered in Chapter 7.

Chapter 8 is devoted to aspects of the process technology for vinyl chloride polymers such as extrusion and vacuum moulding. The optimization of PVC compositions is discussed in Chapter 9 whereas Chapter 10 presents a most interesting view of the problems of recycling the polymers. Accelerated weathering is discussed in Chapter 11 with the prediction of service life left till Chapter 12.

The book is certainly comprehensive with each chapter being independently referenced rather than a compilation at the end of the book. The approach, like many Russian science authors, is often highly mathematical and although this may at first sight seem a little disconcerting the information supplied nevertheless provides a valuable insight and interpretation into the mechanisms involved. The presentation is excellent with well drawn diagrams and very detailed mechanistic schemes and appears to be an excellent translation.

In general the book will form an excellent addition and indeed complement many others in the field of polymer degradation and stabilisation. In conclusion, it is a most useful and valuable text recommended to all scientists and technologists in industry, academia and government research establishments working in the field.

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Rheological Measurement

A. A. Collyer and D. W. Clegg
(Eds.)

Elsevier Applied Science, Barking,
1988, xiii + 647 pages, £87.00
ISBN 1-85166-196-4

This is a good book, borrow it from a library and read it quickly since the material is so new it is likely to go out of date soon. At its price, a library is the only place you will be able to find it.

The book is a collection of articles by eminent rheologists on various topics in rheological measurement. Giving rheologists 50 pages to do their own thing sounds like a prescription for a mad-hatters' tea party but the editors have done a good job. Their Cheshire-cat existence is evident: the grin, in the form

of a uniform format and a tightly controlled subject matter is a pleasure. However, a note in the preface on the book's provenance would have helped. Is it constructed from the proceedings of a conference?

The articles included are: Capillary Rheometry by Mackley; Slit Rheometry by Han; Converging Dies by Gibson; Recoverable Elastic Strain and Swelling Ratio by Tanner; Viscous Heating by Warren; Computer Control and Data Processing in Extrusion Rheometers by Baker *et al.*; Commercial Instruments by France; Elongational Rheometers by Gupta and Sridhar; Rotational Viscometry by Powell; Oscillatory Rheometry by Marin; Normal Stress Differences from Hole Pressure Measurements by Lodge; Sliding Plate and Sliding Cylinder Rheometers by Dealy and Giacomin; Commercial Rotational Instruments by Brownsey; Flow Visualisation in Rheometry by Mackay and Boger; The Rheology of Two Phase Flows by Utracki; and Mathematical Modelling of Two Phase Flows by Barthes-Biesel.

The articles by Brownsey and France seem to overlap. In fact this is not so: France's article should really be called Commercial Extrusion Instruments. There could have been a case for omitting the last two articles in a book on rheological measurement.

All the articles are excellent, if some are clouded by the author's last research paper. Even the ones which, because of the nature of the subject, are literature surveys, are well done. The reviewer would take exception to some things: for example, the use of the word anisotropic for some flowing liquids considered by Gibson seems a little at variance with Oldroyd's definition. However, tea parties are generated by differences of opinion. Perhaps this dormouse should go back to sleep.

The new experimental research student who wants an introduction to the literature of his topic will find this book useful, as well as the expert who knows the subject but 'can't quite remember'. The mathematics is not intrusive. The mathematician with his head in the clouds may come down to earth and sympathize with his experimental colleagues.

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