

## **ADVANCES IN POLYMER SCIENCE, Volume 32** Springer Verlag, Berlin, 1980.

At first sight, volume 32 in this series is a collection of reviews with widely differing themes which bear little relation to one another. After reading, however, one finds that the editors have succeeded in bringing together three areas which are unified by having both industrial importance and an extensive academic literature.

The first review is by far the most substantial occupying half of the available space. It is a comprehensive discourse by Cesca, Priola and Bruzzone on the incorporation of cyclic trienes in poly(isobutene) and ethylene-propylene copolymers and the subsequent reactions which can be performed at these sites of unsaturation. There is a wealth of data on the synthesis and post reactions including radical grafting and crosslinking, and Diels-Alder reactions, which should prove invaluable to those specifically interested in the field, but it is a review mainly for the specialists.

In the second review, Stannett, Koros, Paul, Lonsdale, and Baker have provided a broad brush treatment of recent work in membrane science and technology. There is coverage of gas sorption and transport in polymers, above and below the glass transition temperature, highlighting current thinking on dual mode sorption, followed by a description of gas separation using membranes. The latter has become an important method for extracting fuel gases from mixtures and some remarkable permeability ratios are quoted. Combination of this and hollow fibre technology can lead to commercially viable systems. The applications of membranes in reverse osmosis, ultra filtration, microfiltration and the preparation of liquid and special composite membranes are of particular interest. Good coverage of controlled release systems, both monolithic and reservoir devices, in medicine and agriculture, is followed by a final section on removal of residual monomer from fabricated items where there are health hazards. It is a wide ranging, informative and interesting chapter for the general reader.

The final contribution by Henriç Olivé and Olivé deals with polyacrylonitrile and some of the important intermolecular interactions influencing the behaviour of this material. The effect of strong dipole-dipole interactions on the stress response, glass and melting temperatures is covered first. The authors then concentrate on aspects of hydrogen bonding and water structure and their influence on the polymerization process and the behaviour of the polymer as a fibre. This is followed by an account of electron donor-acceptor complexes involving the nitrile group and Lewis acids.

The volume maintains the usual high standard of this series and should be a must for libraries, but the diversity of content will deter personal purchase.

*J. M. G. Cowie*

## **ADVANCES IN POLYMER SCIENCE, Volume 33,** **'Electrical Phenomena in Polymer Science.'**

ISBN 3-540-09456-3;

Springer-Verlag; 174 pp. 1981

This, the thirty third volume in the 'Advances in Polymer Science' series, deals with the topic of Electrical Phenomena in Polymer Science by way of four isolated contributions from different authors. The reader will be disappointed should he approach the text in expectation of finding a comprehensive treatise on polymer electrical phenomena. It is not. Rather, the title serves as the most concise description of the common subject area for the four specific papers.

The first contribution is from the pen of Dr G. Mengoli of Padova, Italy and is entitled 'Feasibility of polymer film coatings through electro-initiated polymerization in aqueous medium'. Here, the author surveys the scientific literature and discusses the feasibility of and the current procedures used in the modern development of forming protective polymer coating on metal surfaces by direct electropolymerization on the surface. Much of the description is given by comparison with the more commonly used process of electrophoretic deposition. Particular emphasis is laid upon aqueous polymer media and on the kinetics of coating formation. The article should be a good starting point for the development engineer who wishes to learn about surface electropolymerization.

The same topic forms the subject of the second contribution by R. V. Subramanian of Washington State University. Under the general title of 'Electroinitiated polymerization on electrodes', this author gives a readable description much more from the viewpoint of the structure and morphology of the deposited polymer. He reviews mechanisms of polymerization and tries to relate them to the final adhesion properties of the polymers. Coatings formed from vinyl, phenol, acrolein, benzonitrile, polyimide and phenylacetylene monomers are all discussed in some detail. A topical and interesting discussion of carbon fibre electrodes is also given.

Half way through the volume a transition occurs. Just as the reader is getting 'stuck into' polymer metal adhesion, the material 'relaxes' into dielectric relaxation studies for the third and fourth articles. Professor G. Williams of Aberystwyth supplies the first of these with a paper entitled 'Molecular aspects of multiple dielectric relaxation processes in solid polymers'. These phenomena are discussed for both amorphous and crystalline polymers. Models are given for the various modes of motion in terms of dipolar relaxation theory. The novelty of the article lies in its attempt to present a clarified, comprehensive description of relaxation processes in terms of time correlation functions rather than from a partial or full consideration of the polymer chemical

structure. With such an approach, the author is able to indicate and highlight the characteristics of solid polymer electrically excited relaxations.

As a readable review and a description of general polymer dielectric behaviour, the final contribution by Dr H. Block of Liverpool University is worth waiting for. Under the title 'The nature and application of electrical phenomena in polymers', the author follows a general description of the dielectric properties and relaxation processes in polymer solutions with an interpretive account in terms of polymer structure and motion. From this standpoint, the author proceeds to a description of electrically induced process in solid polymers. Sections then appear on thermally stimulated electrical discharge, piezo- and pyro-electric polymers, conducting polymers and photoconductivity in polymers. Each of these topics is discussed in terms of molecular structural characteristics and assessed for their practical utility. This is an excellent article for the newcomer to the basic dielectric properties of polymers who wishes to know what is important and relevant at the present time.

Overall, the dual nature of the material in the book is disappointing. It would have been far more useful as a single volume devoted to either of the major topics discussed. As it is, it simply provides a repository for four relevant review articles in specialized areas of polymer dielectrics.

*B. R. Jennings*

## **ADVANCES IN POLYMER SCIENCE, Volume 37,** **Cationic Ring-Opening Polymerization of Heterocyclic Monomers** *S. Penczek, P. Kubisa and K. Matyjaszewski* Springer-Verlag, Berlin, 1980

Volume 37 of this well established series consists of one long article (156 pages). The authors deal in considerable detail with the mechanisms of the reactions involved in the ring-opening cationic polymerization of heterocyclic monomers, although in practice most of the discussion is concerned with the much studied example of tetrahydrofuran. After a brief introduction the review is divided into sections on Monomer Structures, Ring Strain and Nucleophilicities; Initiation; Propagation; and Termination and Transfer Processes. The literature is covered through to the end of 1979 with a few references from early 1980.

The authors present their critical analysis of knowledge in this area with convincing thoroughness and both specialists and the general reader will find the review stimulating.

The language used is understandable, although some of the occasional awkward constructions which interrupt the flow of the manuscript should have been eliminated at the editorial stage. The book is well produced, apart from the minor reservation noted above, and there are very few typographical errors.

It can reasonably be expected that this review will be well received and will stimulate much further work and discussion.

*W. J. Feast*

**ADVANCES IN POLYMER SCIENCE, Volume 38  
Polymerization Processes  
Springer-Verlag, New York,  
Heidelberg, 1981, 170 pages,  
\$46.10. ISBN 0-387-10217-5.**

Volume 38 of this series contains five articles written by separate authors. The articles vary in both their purpose and subject matter.

The first article, by N. Yamazaki and F. Higashi, deals with new condensation polymerisations which are promoted by phosphorus compounds. This is concerned largely with work which has been carried out by the authors during the last 10 years. The review sets out the reaction types in a systematic manner. It covers the formation of polyamides, polypeptides and polyesters. The discussion is concise and reasonably clear (34 references).

The second article by G. Silvestri, S. Gambino and G. Filardo discusses the electrochemical production of initiators for polymerisation processes. This deals with the synthesis of complex catalysts and the direct electrocatalysis of polymerization. The discussion is detailed and reviews the publication of many workers (133 references).

In the third article, M. Kamashi deals with the influence of solvents on the free-radical polymerisation of vinyl compounds. This is not merely a factual account but an historical review of the development of basic ideas. The reasons why rate coefficients depend on solvent type are discussed in a quantitative manner. The article is well-researched and presented clearly (146 references).

The fourth article, by A. A. Berlin, S. A. Volfson and N. S. Enikolpian is entitled 'Kinetics of Polymerization Processes'. Primarily, it is a review of work carried out in the Soviet Union during the last five years. Both ionic and free-radical polymerisation are covered. The variation of chain termination rate coefficients with radical size is treated in some detail and the possibilities of 'living' radical polymerizations are discussed. The article includes thermodynamic effects in the kinetics of ionic heterogeneous polymerization. In conclusion, there is a substantial quantitative discussion of models which may be used to describe polymerization processes. This is a useful review and the authors have been successful in relating recent Soviet work with work which has been carried out elsewhere (145 references).

The last article, by J. P. Kennedy and J. M. Delvaux, deals with the synthesis, characterisation and morphology of polybutadiene-polystyrene graft copolymers. Unlike the other sections of the book, this is an original account of new experimental research.

A study has been made in which polystyrene cations are grafted on to polybutadiene. Model reactions have been used as an aid to understanding the process. The effect of reaction conditions on the efficiency of graft formation is evaluated (40 references).

Obviously, this is a book for those who are familiar with polymerization processes already. The standard of work is high and generally the presentation is clear. In all cases, the references include recent publications; the papers were received by the editors between July 1979 and June 1980. Few readers will be concerned equally with all of the articles but those workers who specialise in one of the fields which is covered will find the consultation of the book worthwhile.

*B. W. Brooks*

**'Semiconducting Polymers'  
Marian Kryszewski  
PWN-Polish Scientific  
Publishers, Warsaw, 1980**

The contribution of Professor Kryszewski and his coworkers at the Polish Academy of Sciences in Lodz will be well known to those interested in semiconducting polymers. His many personal contacts both in the East and West are reflected in the authoritative way in which he is able to discuss the literature from a large number of research workers. The original Polish version of the book appeared in 1968. The English translation was prepared during the period 1970-74 and was rewritten and extended to include the literature which appeared during this period. Literature published in the period 1974-78 has been collected into a final chapter which is entitled 'Recent Trends'. This complements the first eight chapters and extends the discussion to cover more recent advances in selected topics. Professor Kryszewski has made a valiant effort to produce a comprehensive review of the literature for which he must be heartily congratulated. However, one feels that because of the volume of literature covered certain of the sections lack a directness required to maintain the reader's interest. As with any translation, the occasional lapse of syntax is to be expected. These are rare and the style of writing is in general good. For a book for its size 594 pages — the number of typographical errors are small, a few minor slips, such as Linschitz for Linschutz, occur but these will not distract the reader from an appreciation of the breadth and thoroughness of the coverage of the literature. The first three chapters are concerned with fundamentals and describe the general character of semiconducting polymers, their preparation and physical/chemical properties. These chapters are well organised and indexed allowing the reader to easily find the particular topic of interest. Chapters 4-8 deal with magnetic, catalytic activity, photoconductivity, biological semiconductors and methods of measurement of electrical and photoconductivity. Unlike the first three chapters the text is not as well divided into subsections and it is somewhat more difficult to access topics of particular interest. Chapter 9 complements the preceding chapters and reviews the literature from 1973 to 1978. It is divided into sub-sections similar to those used for the previous eight chapters and as such

reflects the general organisation of the book indicated above. A minor irritation was the use of italics for the references in this section. Instead of following on with the numerical order of references used in the previous chapters, a separated bibliography is used for this chapter and the references are distinguished by being in italics. This point is made in the preface. However, the reader may find himself a little confused since chapter 9 also contains references from the main body of the text, and differentiating between italic and normal numerals is not always easy. An additional point which would have eased reference to the data would have been the greater use of subheadings in this chapter. For instance, it is not directly obvious that the discussion of  $(SN)_x$  starts on page 442 and extends to 446, likewise polyacetylene pp. 446-454 and polydiacetylene pp. 454-455. Despite these minor criticisms, the reader should find this a very authoritative work in which the author has added his skill and experience to the discussion of many of the mechanistic points concerned with the interpretation of charge migration in these systems. I would anticipate that this text will be eagerly consulted by all interested in semiconducting polymers and should find a place in all University libraries. Unfortunately, any book on such an actively researched field is of necessity bound to be out of date before it is published. The growth of activity indicated by Professor Kryszewski into polyacetylenes has, in fact, occurred and has attracted considerable interest with the appearance of the polymeric battery. For the reader interested in this particular area, a review by MacDiarmid<sup>1</sup> is strongly recommended. In conclusion, *Semiconducting Polymers* is a book well worth a read, and for the worker in this field may be considered to be the most recent authoritative reference on the subject, and as such an essential addition to their library.

<sup>1</sup> A. G. MacDiarmid and A. J. Heeger 'Organic metals and semiconductors: The Chemistry of Polyacetylene ( $CH_x$ ) and its derivatives', *Synthetic Metals*, 101-108 (1979:80)

*Richard A. Pethrick*

**MOLECULAR ELECTRO-OPTICS Electro-optic Properties of Macromolecules and colloids in solution  
Edited by Sonja Krause  
Plenum Press (Volume B64  
NATO Advanced Study Institute Series) New York, 1981 — \$59.50.**

Electro-optic investigations of polymers and colloids are not used on a routine basis to characterize their structure, but as this volume shows the techniques grouped under electro-optics are capable of supplying a variety of fundamental information intimately associated with structure. Kerr effect, electric linear dichroism and electrically induced fluorescence are related to molecular