book reviews

Polymer Alloys and Blends: Thermodynamics and Rheology

L. A. Utracki (Ed)
Carl Hanser Verlag, Munich, 1990, 356 pages, DM 148.00
ISBN 3-446-14200-2

I approached the reviewing of this volume from two different points of view. I have been working in the field of polymer blends for over a decade, and have an on-going research effort in several aspects of the fundamentals of the field. At the same time I am a teacher, involved with the education of young research workers. Wearing the first hat, I asked myself 'what does this volume add to the extensive and growing literature on polymer blends and alloys?' Wearing the second hat, the question is whether I would recommend the book to my students, and if so, for what purposes. Clearly the two aspects overlap, and ultimately they both reduce to whether I would want this volume on the shelves in my own office or laboratory, or whether I am content to let it rest in the reference libraries. Having had the book to hand for a few weeks, the answer is that neither I nor my students would care to see it move far from the office or laboratory. It is an extremely valuable addition to the literature, and in fact is quite unique in its contribution so far.

The book is in three sections. Part 1 is an historical, technical and economical survey of the field of polymer blends and alloys. Part 2 covers the thermodynamics of polymer–polymer miscibility, including both the theoretical approaches developed so far, and the many and varied techniques involved in observing miscibility levels and limits. Both of these areas have been covered in textbooks previously, although not perhaps in so pragmatically practical a tone, or so concisely. The third part, however, brings a new addition to this area of the literature. It is a survey of the rheology of both miscible and immiscible systems. A short section on the new but important area of shear-induced miscibility is also included. Since in practice most blends have to be processed, an understanding of the interactions between rheology and thermodynamics is crucial for a complete understanding of the properties of blended polymers. However, the experts in the two areas usually come from quite different backgrounds, so that it has not been usual to see full developments within the same volume.

It is, in part, the juxtaposition of science and technology, of thermodynamics and rheology, that gives this book its unique flavour. Just as valuable, however, are the numerous tables, appendices and indexes which between them summarize and make accessible the vast and growing literature of blends and alloys. The author claims to have read 20,000 references and patents and to cite over 1,000 in the text. I have not counted myself, but I can vouch for the extensiveness of the tables and the relative ease with which information on a particular blend can be tracked through the text.

It was on these surveys of the current literature that my own students first commented favourably. My own view is that the theory sections are ideal for someone who already knows the field to some extent, but perhaps a little brief for the absolute beginner. The students, however, found the organization and conciseness helpful.

In summary, therefore, both the beginner who wishes to find his way in the field and the expert who wants a concise reference summary will find this volume indispensable.

J. S. Higgins
Imperial College

Degradation and Stabilization of Polymers: Vol. 2

H. H. G. Jellinek (Ed)
Elsevier Science Publishers, Amsterdam, 1989, 720 pages, $234.25/DFl 445.00
ISBN 0-444-87402-X

This book is the second in a series of review volumes, originally edited by Professor H. H. G. Jellinek. The book was in preparation when Professor Jellinek died in 1986 and it has been completed by Dr H. Kachi. The inevitable consequence is a delay in publication, which means that not all of the most recent literature is covered.

There are eight chapters, covering a wide range of topics in polymer degradation. Photodegradation is the subject of three chapters. A review by Scaino covers laser flash photolysis in a general way, with a few polymer examples. Itagaki and Mita provide an extensive review of photophysical processes in polymers and their relevance to photo-oxidation chemistry. Webb *et al.* review photodegradation of polymer films on reflecting surfaces, emphasising the application of infra-red reflection methods for monitoring degradation.

Polymer combustion is the subject of a chapter by Khalturinsky and Berlin. This is extensive but covers the literature only up to 1983, with the result that it has an old-fashioned feel in a field which has been developing very rapidly. Biodegradation is covered in a paper by Zaikov, mainly directed at polymers which are designed for applications in surgery and in drug release, where degradability is encouraged. Ozone-induced degradation of rubbers is discussed by Razumovsky and Zaikov, in a chapter which also has very few recent references. Copper catalysed oxidation of polyolefins, a topic of major importance in the electrical industry, is reviewed by Jellinek in a chapter which is, inevitably, incomplete.

The largest single chapter of the volume, occupying almost one third of the total, is a review by Ivan, Kelen and Tudos, of the degradation and stabilization of poly(vinyl chloride). This is a major compilation of the literature (846 references) but coverage stops at 1985. A number of recent developments, e.g. the applications of high-field n.m.r. and of resonance Raman spectroscopy, are not covered.

This volume contains much of value. It inevitably suffers from the delay in publication and the patchy way in which different authors have (or have not) updated their contributions. It is well produced, from camera-ready typescripts in several different styles. Few individuals will want to buy it, but it should be in the library of any group interested in polymer degradation.

N. C. Billingham
University of Sussex

Infrared Spectroscopic Atlas of Polymers

J. G. Dillon
Technomic Publishing Co. Inc., Lancaster, PA, USA, 1989, 195 pages
ISBN 87762-615-4

There has been a need for some time for a specialist book on infra-red spectroscopy of polyurethanes in all their manifestations. The information has been available in the literature, of course, to enable the researcher to assign a particular absorption peak to an appropriate chemical entity. However, to this reviewer's knowledge, this is the first time the data have all been gathered together in one work of reference.

The atlas, an apt description, is a listing of the peak wavenumbers and assignments of virtually every known polyurethane, its precursors and model compounds. What it does not give is any of the experimental techniques required to produce the spectra. The book is, therefore, for the specialist.

The atlas is divided into three parts: model compounds, polyurethanes, and biomedical polyurethanes. In addition a set of appendices has been added. These include a chemical compound index, a frequency index, and a chemical group correlation chart. The term "polyurethane' covers a wide range of chemical entities including poly(ester urethanes); poly(ester urethane ureas); poly(ether urethanes); and poly(ether urethanes ureas). All are included, together with their low molecular weight analogues.

Each page in the main section of the book gives the chemical structure of the compound being described, its chemical/polymer components (polyol soft segment, isocyanate and chain extender) and a listing of the wavenumber and assignment. Sources are referenced throughout.

It would be difficult to fault the book as a work of reference. The section on biomedical polyurethanes could be particularly useful in this rapidly expanding field. It is also a must for everyone working in a laboratory with an infra-red spectrometer.

J. Ferguson
University of Strathclyde

Plastics Films, (3rd Ed.)

J. H. Briston
Longman Scientific, Harlow, Essex, 1989, 434 pages, £29.00
ISBN 0-582-01490-5

This is the third edition of a book which has become a well known text to students in the plastics and packaging industries. The original format has been retained but extensively revised and updated to cover advances in materials and conversion processes during the past six years.

After a brief introduction, the book divides into four parts: film-forming materials; manufacture and properties of films; conversion of films; and applications. Part 1 contains six chapters, providing a good outline of the structures, properties and applications of the wide range of industrially important film-forming polymeric materials. These chapters contain a great deal of information and are a valuable source of reference. Part 2 is the major section of the book, and Chapter 8 describes the major techniques for manufacturing film. Explanations of complex machinery are easy to understand and are assisted by clear diagrams. Chapters 9 and 10 discuss the mechanical, chemical and physical properties of plastics films that are important to the end use of the material and for the packaging operations. Also included are various test methods that are used for the measurement of such properties. Two chapters, on the key topics of Health Safety and Organolepsis, have been re-written by Dr Leonard Katan and considerably updated. Given the current concerns about irradiation as a method of food sterilization/preservation, I am surprised that greater emphasis is not given to this topic. There is good coverage of the legislative aspects of food packaging materials, with sections on the law in various countries world-wide. This part finishes with a nice chapter on choice of materials.

Part 3 contains six chapters on the conversion of films. Again, the author has provided good coverage and clear descriptions of techniques. This edition includes new or expanded sections on modern processes. The final part covers, in seven chapters, a range of applications for plastics films, and certain environmental issues. Packaging forms the largest outlet for plastics films, and this topic is given appropriate weighting. The book is completed with a series of four appendices on: properties of plastics films (a table of data); identification of film materials (a summary of test methods); trade names (a list); and additives for plastics films (a description of the various types used). Many, but not all, chapters contain recommendations for further reading, and there is an adequate index.

Overall, this is a book that I shall continue to use and recommend to students seeking knowledge of plastics films.

G. C. Corfield
Humberside College of Higher Education

Photoreactive Polymers: The Science and Technology of Resists

A. Reiser
John Wiley and Sons, Chichester, 1989, 409 pages, £35.85,
ISBN 0-471-85550-2

This book has arisen from the author's experiences in teaching graduate and post-graduate courses. He has also participated in courses in surface coatings science and technology for industrial materials scientists and engineers.

The science and technology of resists is of increasing importance. It draws from, and contributes towards, the ever important topic of reactive, curable systems based on excitation by electromagnetic radiation in the u.v. range and in particular radiation in electron beam curing.

The text is stated to be designed to give a balanced view of the subject as it now stands and, at the same time, promote an understanding of the perennial challenge of material science: 'to meet the demands of new technology by the successful design of new materials'. Careful scrutiny of the text clearly demonstrates that the author has more than fulfilled his objectives. The text is timely, well written, balanced and comprehensive. It is presented in a sympathetic and logical manner.

Each of the ten chapters is accompanied by a comprehensive and up-to-date bibliography. The detail given in the chapters, together with the rigour of treatment reflects the intended audience.

In chapter one (20 pages, 22 references) we are treated to a brief history of resists with emphasis on the early history of resists, synthetic photopolymers and photofabrication.

Chapter two (42 pages, 69 references) deals with the physical chemical and the photochemical aspects of crosslinking processes as encountered in negative photoresist systems. Attention is given to the reactions of excited chromophores including those encountered in water-processable resists and resists based on photoinduced polarity changes. The physical chemical aspects which are considered include gel point exposure and photographic sensitivity, quantum yield studies and the physical chemical features of resist processing.

Chapter three (36 pages, 84 references) is concerned with relevant features of the photophysics and photochemistry as experienced by solid polymers. Topics dealt with include excimers, energy transfer phenomena and migration phenomena, spectral excitation, and electron transfer sensitization. Special attention is given to the photochemistry of amorphous solids of significance to the development of resists, in a manner which is sympathetic in style, yet thorough.

Chapter four is the first of the chapters dealing with the chemistry and technology of photoresist systems and methodology. It is concerned with the broad topic of photoinitiated polymerization. It is reasonably comprehensive (77 pages, 159 references), taking the classical presentation line. Thus, photofragmentation, H-abstraction and ligand exchange approaches are dealt with. Kinetic aspects are considered as are photopolymerizations carried out in amorphous solids and in the crystalline phase. The subjects of photoinitiated step-growth polymerization (thiol-ene) and of photoinitiated cationic polymerization (onium