Overall the book presents equations of plastics engineering that form the basis of computer models but it deliberately avoids details of the numerical routines themselves. In the section on cooling of injection mouldings there is a brief reference to finite difference methods but they are not mentioned at all in the chapter on heat transfer. Although there are other books which deal with computer modelling for polymer processing, it might have been useful if the equations presented here were linked in slightly more detail with possible computer implementation.

The book is well produced and clearly laid out with important equations highlighted, though perhaps more care could have been taken with proof-reading of the text. For the English-speaking reader the fact that many of the references are to the German literature could be a minor irritation. Generally, however, the book is clear and helpful, and subject to the provisos mentioned above should prove useful to polymer engineers involved in design.

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Liquid Transport Processes in Polymeric Materials: Modelling and Industrial Application

J. M. Vergnaud
Polymer Science and Engineering Science Series, Prentice Hall, 1991, £70.60

This book contains a mixture of two different styles. The first half deals with the mathematics of classical Fickian diffusion applied to a number of different geometries while the second half is more specific to polymers and has chapters on diffusion into and out of PVC, rubbers, wood and drugs. The first half has no references and reads rather like an undergraduate mathematical text while the second half has many references and is more reminiscent of published conference proceedings on diffusion. Sadly this reviewer finds the overall balance wrong and the book difficult to read or enjoy. This is a great pity as the book does contain useful information in a subject area that is of great importance.

There are many engineering texts on the analytic and numerical solution of the Fickian diffusion equation both for steady state and unsteady diffusion and for all of the geometries covered in the book, i.e. planar cylindrical and spherical geometry. Some readers may find the presentation of the results useful but in my opinion the results are somewhat fragmented and there seems to be little flow and too many subdivisions to the first seven chapters.

The final chapters probably hold a greater interest to the polymer scientist and the sections on PVC and rubber in particular contain plenty of experimental data. However, in these chapters the central issue of the concentration dependence of diffusion coefficients with polymeric materials and the additional rheological constitutive response are touched on but not rigorously developed, as in the earlier chapters.

Overall the book is disappointing and seems expensive. It may, however, contain some experimental gems that have not been picked up by this reviewer, which might justify enthusiasts of polymer diffusion delving deeper into the text.

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Modern Methods of Polymer Characterisation

H. G. Barth and J. W. Mays (Eds)
Wiley Interscience, 1991, £86, ISBN 0-471-82814-9

The book is volume 113 of the series of monographs on *Analytical Chemistry and its Applications*. It is written with two audiences in mind: those with little background in the field who want to know more about the techniques and applicability and those with some expertise who require an updated review of recent advances. The 12 chapters are written by a variety of contributors who meet these aims to varying degrees.

Chapters which meet the objectives well include those on size exclusion chromatography (s.e.c.) and h.p.l.c., field flow fractionation (f.f.f.), inverse gas chromatography (i.g.c.), photon correlation spectroscopy (p.c.s.), osmometry and viscometry. The last two provide an excellent reminder that in these days of 'high tech' methods, some of the classical techniques can still provide fairly rapid and low cost means of determining molecular weight and dimensions. Both chapters give a good overview of the practical techniques. Modern instruments for membrane and vapour pressure osmometry are well covered. In contrast to these traditional methods, f.f.f. and p.c.s. are relatively new and there is still the potential for significant development of experimental techniques and instrumentation. The chapters on these topics provide the newcomer with a good introduction to the fields and contain a good balance of the theoretical background, instrumentation and applications. The chapter on p.c.s. provides some useful practical tips and that on f.f.f. gives a neat comparison of the relative merits of this technique and s.e.c.

Chapters which are less well balanced are those covering data reduction in s.e.c. and polymer characterization using the ultracentrifuge. The former contains much theory and repetition of points covered in the immediately preceding chapter on s.e.c. and h.p.l.c. There is an overemphasis on deriving equations, several of which are only of practical value to simple systems. The final conclusions of this chapter do, however, give a good summary of some of the pitfalls in interpreting s.e.c. data. The chapter on the ultracentrifuge does not cater very well for a newcomer to the field. Little space is given to instrumentation and what comments there are assume a prior knowledge of the technique. The limitations of the method are well covered, but one is left with the impression that the technique is primarily applicable to biopolymers, particularly DNA.

The final two chapters cover the application of n.m.r. and mass spectrometry for polymer characterization. The advances in high field liquid and solid state n.m.r. have turned n.m.r. into a very powerful technique for polymer characterization, particularly for probing polymer microstructure and determining polymer dynamics. The difficulty faced by the author is to convey this richness in the short space available. In some areas this is done successfully, as in the summaries of special pulse sequences and 2-dimensional experiments. However, in other instances the author is tempted to venture too deep in too little space. An example of this is the detailed coverage given to reaction probability models for interpreting copolymer sequence distributions. In other parts of the chapter a good overview is given, such as the use of relaxation parameters to provide information on polymer dynamics, the brief introduction to high resolution solid state n.m.r. and the use of cross polarization/magic angle spinning techniques. Perhaps a little more space devoted to solid state and a little less to the details of reaction probability models would have improved the overall balance of the chapter. The advances in mass spectrometry are covered well, but the lasting impression is that, despite the progress, further advances will be required before the technique becomes generally applicable to high molecular weight polymers.

Overall, the volume gives a good introduction to the techniques it covers and will therefore be useful to the newcomer. It is probably of less value to those who are familiar with the field because the literature is covered only up to about 1988 and in some instances only as far as 1987. For the newcomer who wants a complete overview of techniques for polymer characterization, there are some surprising omissions. For instance, no coverage is given to techniques for thermal analysis, vibrational spectroscopy

or X-ray diffractometry. The omission of thermal analysis is particularly surprising since in the preface the characterization of polymers is defined as the study of 'the kinetic and thermodynamic interactions of a polymer with its environment'. Nevertheless, the book does give a reasonable overview of those techniques that it covers.

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Protective Groups in Organic Synthesis (2nd Edn)
Theodora W. Greene and Peter G. M. Wuts
John Wiley, New York, 1991, 437 pp.,
ISBN 0-471-62301-6

Protecting groups are used in organic synthesis to temporarily mask a particular reactive group whilst reactions are carried out at other functionalities in the same molecule. A classical example is the protection of a ketone group from attack by nucleophiles by its conversion into a ketal. After nucleophilic reagents have reacted at other sites in the substrate, the ketal group is then converted back into the ketone group (deprotection). Since protecting groups are used when compounds are polyfunctional, success often depends on *selectivity*. Accordingly a wide range of protecting groups is needed to cope with the many different selectivity requirements that can arise. Although very few major organic syntheses can proceed without them, protecting groups are a cinderella area of organic synthesis. Over the years very few books have been published on the subject and Theodora Greene's book published in 1981 rapidly became the bible for the subject. Peter Wuts has now produced a second edition of the book. Two new sections dealing with the protection of various nitrogen-containing functionalities have been added and the second edition contains the following eight chapters plus a subject index:

1. The role of protective groups in organic synthesis
2. Protection for the hydroxyl group, including 1,2- and 1,3-diols
3. Protection of phenols and catechols
4. Protection for the carbonyl group
5. Protection for the carboxyl group
6. Protection for the thiol group
7. Protection for the amino group
8. Reactivities, reagents and reactivity charts

The book does not claim comprehensive coverage of the subject; for example, there is no consideration of the protection of olefins, dienes and benzenoid aromatic compounds, but the topics that are covered are covered very thoroughly with a large number of original references. Chapter 8 is invaluable at finding routes through the mazes that arise from selectivity requirements.

The reader of this review may be wondering about the relevance of this topic to polymer chemistry. As the following examples show, the chemistry described in this book can be exploited in various ways.

First, many protecting groups can be used in monomers to permit and/or to control polymerization. Thus, the use of the acetate group in vinyl acetate permits, via polymerization and deprotection, the synthesis of poly(vinyl alcohol). However, many other groups could be used and recently, for example, the group transfer polymerization of vinyl trimethylsilyl ether and vinyl di-t-butylmethylsilyl ether have been studied as routes to poly(vinyl alcohol). The anionic polymerization of various protected styrene derivatives is also being studied.

Second, derivatives of the protecting group type can be used to modify the solubility of a polymer. An example here is in resist chemistry where various acid-sensitive derivatives of vinylphenol are used to give polymers that can be made alkali-soluble in the presence of compounds that on irradiation release acid catalysts.

Finally, many organic protecting groups can be improved by attachment to an insoluble polymer support. The classical example is the Nobel Prize winning work of Merrifield who carried out peptide synthesis with the carboxyl end of the chain protected as a polymer-supported benzyl ester.

There are undoubtedly many other protecting groups that could be exploited in polymer chemistry. For those who wish to work in this area, the present book is an indispensable gold mine of information and references.

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