book reviews

Thermoreversible Gelation of Polymers and Biopolymers

J.-M. Guenet
Academic Press/Harcourt Brace Jovanovich, London, 1992, pp. 280+ix, £40.00
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Studies on thermoreversible gels formed from biopolymers have been pursued for many years, whilst progress on gels formed from synthetic polymers is more recent in origin. However, only in the last decade or so have workers examined the parallels and differences between the two classes of materials. In this respect the present book, which may be the first single author work to adopt this viewpoint, is indeed timely.

Thermoreversible gels occur as materials essential to a number of industries as adhesives, in separation, purification and photographic media and as encapsulating agents in the pharmaceutical industry. In Japan especially, food gels are widely consumed. The present volume appears to serve both as a review for experienced researchers and also as an introduction to those less familiar with the area, whether from academia or from these industries. However, as it is one of the first volumes attempting to link the two areas it has a responsibility to be broad based and equivocal. To the present reviewer it does not always succeed in these respects.

The text is concerned essentially with the physics and physical chemistry of the gelling systems. The parts on thermoreversible synthetic polymers, the author's own field, appear to be covered slightly patchily. For example, many readers will be surprised to see quite so many citations of the author's own work, with comparatively little reference to the contributions, for example, of Keller and co-workers. Nevertheless there are some interesting insights. However, this reviewer considers that the sections on biopolymer gels are covered rather too eclectically, and in a way which intimates that the author has not really appreciated either the breadth or depth of past studies.

To suggest that little or no work has been published on cellulose derivatives since the 1950s seems to overlook the substantial contribution made by Japanese workers. The author's comments that the aggregated double helix model for polysaccharide gels is 'but of historical significance' does not coincide with this reviewer's understanding of the area. In fact this thesis is made tenable only by neglecting the very extensive chiroptical (o.r., c.d., o.r.d.) investigations which have been performed on such systems. The author has clearly opted to support alternative models (e.g. those deduced from electron micrographs). He should, perhaps, have made clear that these are almost all incompatible with the measurements mentioned above. It is also disappointing to see that some of the most interesting studies, those attempts to produce synthetic precursors of biopolymers, such as have been carried out by workers in Mainz, are not discussed at all. In this reviewer's opinion, such data will be crucial in helping to distinguish between different theoretical models.

Such criticisms would not be serious if it was made clear at the outset that the book was very much a personal view. However, without such a caveat it cannot be said to cover the ground it really should, and consequently it cannot be recommended very highly. The present reviewer is left with the feeling that to acquire a more rounded view of the area a prospective purchaser may be better advised to peruse one of the several recent multi-author conference proceedings published on thermoreversible polymer gels and networks. Nevertheless the book is competently written, with some interesting anecdotes, carefully illustrated, and well produced, and the price is not unreasonable. It will find its way into Institute libraries, and should be consulted there.

S. B. Ross-Murphy
King's College London

Polyvinyl Alcohol: Developments

C. A. Finch (Ed.)
John Wiley and Sons, 1992, £130.00
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This book is an update to the similarly titled 'Polyvinyl Alcohol: Properties and Applications', also edited by Dr Finch, which was published in 1973. The previous book covered the literature up to the end of 1971; the present one is intended to cover what has appeared in the intervening 20 years or so.

With a world-wide production of about half a million tonnes per year, poly(vinyl alcohol) (PVAL) is clearly the most commercially important water-soluble synthetic polymer. In fact, in this context the connotations of the 'poly(vinyl alcohol)' have to be expanded to include its copolymers with vinyl acetate – which are commercially important because of the industrial production of PVAL from the precursor, poly(vinyl acetate) – as well as the whole range of other vinyl alcohol copolymers (made commercially either by copolymerization in the precursor stage, or by the diverse modification reactions which are so readily and conveniently carried out on PVAL).

The present volume contains 20 chapters, which provide insights into the diverse features of this group of related polymers. After introductory sections by Finch, the first chapter, by Okaya, discusses the general properties of PVAL. Two chapters by Marten and Zvanut then cover the manufacture of the precursor polymer poly(vinyl acetate), and its hydrolysis to PVAL. Various copolymer aspects are covered in a series of chapters dealing in turn with the modification of PVAL by copolymerization (Okaya), end group modification (Okaya and Sato), by carboxylic acid group modification (Maruhashi), with vinyl alcohol copolymers containing ionic and reactive groups (Maruhashi), and with ethylene–vinyl alcohol copolymers (Okaya and Kihari). Two 'basic' chapters then cover the chemical reactions and stereochemistry of PVAL (Finch), and its spectroscopic properties (Dunn). The next eight chapters cover specific applications of these polymers – in textile sizing (Tubbs), films (Masuda), emulsion polymerization (Farmer), paper manufacture (Miller), adhesives, binders, and reprography (Finch) and photoresists (Dunn). This is followed by a chapter by Asahina on the polyvinyi butyral and other acetals which are in large-scale production for safety glass applications, while in the last chapter, Rozenberg and Sorokin discuss PVAL in the USSR. The book is concluded by three appendices, by Finch, outlining analytical methods, health and toxicity regulations, and biodegradability and effluent disposal, in relation to PVAL.

Adding up the number of references at the end of each chapter gives a total approaching 3000 references in the whole book; in several chapters the more obscure references are usefully accompanied by the corresponding *Chemical Abstracts* reference.

The book thus deals with both the fundamental and the applied aspects of PVAL and its copolymers, albeit with some inevitable bias to the latter because of the industrial affiliations of most of the authors, and with a tendency in some cases for the author's text to lapse into a technical brochure for his organization's products.

From the fundamental viewpoint, the Reviewer was disappointed not to see more discussion of the dilute solution behaviour of these polymers. In particular, a good definition of the relation between intrinsic viscosity and molecular weight – that is, the Mark–Houwink–Sakurada (MHS) equation – is necessary both for the molecular weight characterization of PVAL, and to clarify the shape and interactions of the isolated molecule in solution; the Reviewer is very much aware that widely different numerical values have been proposed for the parameters in the MHS equation for PVAL (see, in particular, 'Water-Soluble Synthetic Polymers: Properties and Behavior', Vol. I, CRC Press, Boca Raton, 1983, Ch. 4), and that there is therefore a need for an agreed standard in this area. A validated MHS relationship for PVAL is also necessary to provide a reference point for interpreting the dilute solution behaviour of vinyl alcohol copolymers, as a basis for interpreting their rheological behaviour at finite concentrations in practical systems.

Nevertheless, this book will join the 1973 volume as an indispensable reference on PVAL and related copolymers, and for this reason it is an essential purchase by academic libraries and by the numerous research institutes and industrial organizations involved with this group of polymers. Its price is high, but not unreasonably so in view of the vast amount of information it contains.

Philip Molyneux
Macrophile Associates