

Book Review

Polymer Sequence Determination Carbon-13 NMR Method

J. C. Randall

Academic Press, 1977, 155 pp,
\$16.50, £11.70

N.m.r. plays the leading role in the detailed characterization of polymer structure. The appearance of this book is recognition of the significant contribution of ^{13}C n.m.r. to this field since the publication of F. A. Bovey's book 'Polymer Conformation and Configuration' in 1969. The author is himself a well-known exponent of this technique and important sections of the book are based on his own work.

The first three chapters cover the influence of tacticity or copolymer composition on the appearance of a ^{13}C spectrum, techniques of assigning peaks to different sequences, and the quantitative characterization of sequence distributions. The practical implications of the formal development are well illustrated by specific examples, notably tacticity determination in polypropylene and sequence analysis of hydrogenated polybutadiene (1,4- vs. 1,2-addition) and ethylene/propylene copolymers. The similarity between tacticity and copolymer sequence analysis is emphasized by the use of a binary notation to describe both. In the former, the symbols 0 and 1 represent monomer units of opposite configuration whereas in copolymers the symbols represent chemically distinct monomer units. The quantitative characterization of both types of structure is presented in terms of number-average sequence lengths of like additions. In addition, the more familiar description of vinyl polymer tacticity according to the *m* (*meso*) and *r* (*racemic*) dyad notation of Frisch, Mallows and Bovey is included. Chapter 4 considers the statistical analysis of experimental data according to Bernoullian and first order Markov models, also with the assistance of numerous examples. Chapter 5 deals succinctly with instrumental matters of importance in quantitative studies, including the effect of spin-lattice relaxation and pulse spacing on relative intensities, nuclear Overhauser enhancements and digitization problems. The book concludes with a compilation of ^{13}C studies of vinyl homopolymers and copolymers.

An excellent feature attractive to the novice is the thoroughness with which the spectrum analyses of selected examples are unravelled. In the mathematical sections also, great care is taken to explain each step in the derivations. Occasionally this fastidious treatment of little more than high-school algebra may be slightly irritating to the expert, but the novice may find it welcome. The book's value as a reference work is undermined by the fact that only Bernoullian and first-order Markov statistical models are described in Chapter 4. Granted, it is rare to find exceptions to these

Conference Announcement

Advances in the Preparation and Properties of Stereoregular Polymers

NATO Advanced Study Institute, Tirrenia (Pisa), Italy, 3–14 October 1978

A NATO Advanced Study Institute on the Synthesis and Properties of Stereoregular Polymers is being organized. The conference will be held in Tirrenia (Pisa) Italy, and will consist of a programme of tutorial lectures, discussions and short communications on all aspects of the subject. The aim is to bring together organic and physical chemists and physicists interested in obtaining a broad knowledge of the field. Further details: *for European participants*: Professor Francesco Ciardelli, Istituto Chimica Organica Industriale, Università di Pisa, 35 Via Risorgimento, 56100 Pisa, Italy; *for non-European participants*: Professor R. W. Lenz, Chemical Engineering Department, University of Massachusetts, Amherst, Mass. 01003, USA

Conference Announcement

Developments in Injection Moulding

National College of Rubber Technology, The Polytechnic of North London, 9 and 10 November 1978

A conference on Developments in Injection Moulding is being organized by the National College of Rubber Technology, to be held at the Polytechnic of North London, 9 and 10 November 1978. The conference will consist of eleven lectures from experts in industry and subjects covered will include: process control systems; screw and barrel design and injection moulding materials. For further information contact A. Whelan or J. L. Craft, The Polytechnic of North London, National College of Rubber Technology, Holloway, London, N7 8DB

two in practice, but examples are known e.g. isotactic poly(methyl methacrylate), and it would have been most useful to have at least a summary of formulae for second-order Markov statistics and perhaps also the Coleman–Fox two state model.

In the instrumental chapter, a basic knowledge of Fourier Transform n.m.r. is assumed, but even so the Chapter is very brief. In particular, the vital subject magnetic relaxation in polymers deserves a more extensive treatment. Longitudinal relaxation is mentioned only insofar as it influences relative intensities as a function of pulse spacing. The importance of ensuring complete relaxation between pulses is rightly stressed, but no help is given in estimating the magnitude of relaxation times for a particular chemical structure, concentration, temperature or spectrometer frequency so that the experimental conditions may be optimized. Transverse relaxation is not mentioned at all, yet this phenomenon controls the linewidth. What could be more relevant in a technique concerned with the clearest

possible resolution of small structural differences? It is surprising too that no mention is made of resolution enhancement techniques, though admittedly the use of such methods in synthetic polymer sequence is rare.

The final survey of applications of ^{13}C n.m.r. is comprehensive and studies up to mid-1977 are included. The limitation to vinyl homopolymers and copolymers restricts the usefulness of the book as a reference source. A few more pages could have encompassed structure determination in copolyethers and copolyesters, and recent innovations in chain branching and degradation.

The depth of information provided by ^{13}C n.m.r. justifies such a book as this, and it is recommended as an introduction to the subject. With the help of judicious editing in the earlier chapters, a modest extension could have made it a really valuable manual.

F. Heatley