Polymer Spectroscopy

Uxbridge, UK, 22 - 24 April 1974

During the last years spectroscopic methods - e.g. IR - and Raman-Spectroscopy or ESR and NMR - have become techniques frequently used by scientists working on the field of polymer physics. This development is not surprising, because it has been more and more established that the application of these methods is not restricted to problems concerning the chemical structure of single molecules. The various spectroscopic methods can also provide information about the physical and physicochemical behaviour of macromolecular systems in the liquid and solid state.

The Third European Symposium on Polymer Spectroscopy, held in Uxbridge near London, UK, from April 22 to April 24, 1974, yielded a survey on the present state of knowledge and pointed out possible lines of progress for the future.

The meeting, being attended by about 80 scientists, was organized on behalf of the Section of Macromolecular Physics of the Condensed Matter Division of the EPS, the Polymer Physics Group of the Institute of Physics and the European Polymer Spectroscopy Group and prepared in detail by Dr. D.I. Bower (University of Leeds) and Dr. P.J. Hendra (University of Southampton).

Most of the invited and contributed papers dealt with polymers and related low molecular systems in the solid state.

The state of order and the type of defect structures, related to chain folding and side chain effects, which are known to determine largely the properties of partially crystalline polymers, were specified by IR — and Raman-Spectroscopy (S. Krimm ; K. Holland - Moritz et al.), the spectra being sensitive to chain conformation (G. Zerbi et al.) and interactions between neighboured molecules (D.H. Martin).

A particular Raman active low frequency vibration called "longitudinal acoustical mode", which can be observed in semi-crystalline polyethylene and in solid n-alkanes, is characteristic for systems with lamellar morphology. A central point of the discussion is the influence of the structure of the lamellar surface and of intramolecular defects or side branches on the frequency position and the width of this band (B. Fanconi ; M.J. Folkes, G.V. Fraser et al.).

Hints to special kinds of defects were also given by papers, dealing with ESR (G.C. Stevens, D. Bloor et al.), delayed fluorescence and phosphorescence spectroscopy (W. Klœpffer) and ESCA, a relative newly developed technique of electron spectroscopy for chemical application (D.T. Clark).

A refined knowledge of molecular orientation, as measured by means of IR-, Raman- and fluorescence spectroscopy is required for understanding drawing mechanisms and for testing the applicability of two phase models for uniaxially oriented polymers (D.I. Bower ; H. Siesler).

Different types of molecular motion, characteristic for chain molecules in the solid state, and changes in the motional behaviour due to the influence of plasticiser and linkage and due to phase transitions, were revealed from wide line NMR and pulse NMR data (I.M. Ward ; J.C. Adenis et al. ; K. Bergmann ; B. Ewen et al. ; R.A. Davenport et al.).

^{13}C-NMR studies, concerning the tacticity of polymers, the microstructure of copolymers and the configuration of chain molecules, were another topic of the symposium (H.J. Cantow ; S. Boileau et al. ; A.D.H. Clague et al. ; K.F. Elgert et al.). Due to the increasing number of experimental material the interpretation of the spectra becomes more and more unambiguous.

The type of helical structures in solid and solution was elucidated by inelastic neutron scattering experiments (P.J. Lillford et al.), high resolution NMR measurements (M.H. Louchenz - Lefebvre) and a special NMR technique using chemical shift reagents (G. Weill et al.). It was also shown that the problem of chain conformation may be solved by IR- and Raman-spectroscopy on the basis of model substances (J. Maxfield et al.). Some other papers dealt with Raman scattering on polymer fibres (L. Piseri et al.) the effect of absorbed H_2O molecules on the Raman spectra (J. Maxfield et al.) and the orientation of electronic transition in molecular crystals (A.R. Foweaker).

B. Ewen, G.R. Strobl, Mainz.