

Polymers

Properties and Applications

7

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Introduction to Polymer Spectroscopy

With 80 Figures



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This book is dedicated to

ERWIN SCHAUENSTEIN
Professor of Biochemistry
at the University of Graz

on the occasion of his 65th birthday.

Preface

This book has grown out of several courses of lectures held at the University of Mainz in the years 1978 to 1981, at the Ecole Polytechnique Fédéral, Lausanne, and at the University of Fribourg, Switzerland. The last two courses were held in the framework of the "3e Cycle" lectures in June 1981.

According to this genesis, the emphasis of the book lies on a unified and concise approach to introducing polymer spectroscopy rather than on completeness which, by the way, could hardly be achieved in a single volume. In contrast to other books on this subject, equal weight is given to electronic spectroscopy, vibrational spectroscopy and spin resonance techniques. The electronic properties of polymers have been increasingly investigated in the last ten years; until recently, however, these studies and the spectroscopic methods applied have not generally been considered as part of polymer spectroscopy.

The increasing use of electronic spectroscopy by polymer researchers, on the other hand, shows that this type of spectroscopy provides efficient tools for gaining insight into the properties of polymers which cannot be obtained by any other means.

Although the main aim of the book is a didactic one, it should also be useful as a first survey to polymer researchers not specialised in spectroscopy or even to specialists in one or the other spectroscopic technique wishing to orient themselves outside their own field of research. Much emphasis is therefore given to the understanding of the basic processes and mechanisms involved in each method, which are dealt with in an elementary fashion. Both differences and similarities between low and high molar mass compounds with regard to their spectra have been elaborated. The peculiar status of macromolecules, somewhere between molecule and one-dimensional crystal, is demonstrated in many instances. At the end of each chapter, the strength as well as the limitations of the method are delineated, showing that only the combination of several methods can yield an adequate picture of a given polymer.

This book would never have come to live without the initiative and constant interest shown by Dr. F. L. Boschke, Springer-Verlag. It was originally planned as a multi-authored volume; the help and encouragement I got in this early phase by H. J. Cantow (Freiburg), J. J. Verbist and J.-N. André (Namur), H. Kashiwabara (Nagoya) and R. Kosfeld (Düsseldorf) is gratefully acknowledged.

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Most of my own research, which is quoted in Chapters 3 and 4, has been performed within the "Battelle Institute Programme in Physical Sciences".

Preface

Finally, I would like to extend my thanks to all colleagues who sent me reprints and manuscripts before publication, to A. Braun, Lausanne, for organising the guest lectures in Switzerland and, last but not least, to my students for their endurance and for their comments.

Frankfurt am Main, June 1983

Walter Klöpffer

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