

Preface

This book outlines and explains the application of fluorescence measurements in polymer research. It shows examples of important studies of complex polymer-containing systems by various fluorescence techniques. The book is not intended to provide an exhaustive survey of all the important fluorescence studies of polymer systems. It outlines several areas in polymer science where the application of fluorescence techniques can successfully contribute to research. The selection of topics and the structure of the book were subject to the following criteria (1) the individual chapters should give the reader an overview of both seminal works and relatively recent studies of polymers using fluorescence techniques; (2) it draws attention to the great potential of fluorescence for investigating complex polymer-containing systems; (3) it accentuates the most important differences between the behavior of low- and high-molar-mass systems and the consequences for the methodology of fluorescence studies of both types of systems; (4) last but not least, the described examples and analyses of their results should be inspiring for a fairly broad community of researchers (both polymer scientists and experts in spectroscopy). It follows that the text is not only a collection of specialized reviews for a relatively narrow group of experts (i.e., for polymer scientists who have been actively using advanced fluorescence techniques for a long time), but its goal is multifold.

First, we would like to address polymer chemists and physicists who plan to employ advanced fluorescence techniques (by themselves or in cooperation) and would like to explore the potential of fluorescence measurements to as great a degree as possible. The pertinent chapters outline the theoretical basis for fluorescence techniques, give hints about which polymer problems are worth studying by fluorescence methods, and draw the attention of the reader to the non-negligible risks associated with incorrect interpretation of the experimental data. Secondly, we would like to help experts in spectroscopy who intend to cooperate with polymer scientists to orient themselves in polymer physics and physical chemistry (at least in several areas of polymer science and technology). The book is intended to facilitate communication among the members of interdisciplinary research teams studying systems containing polymers.

The beginning of the book contains general chapters on the conformational behavior of polymer chains and association processes in polymer solutions. The first chapter on general conformational behavior is presented concisely in an almost textbook-like manner. It summarizes the most important features of conformational behavior. Even though this chapter is only of marginal interest for polymer scientists, it provides useful information for experts in spectroscopy who plan to carry out experimental studies of systems containing polymer components. The chapters devoted to self-assembly are brief up-to-date review articles and may be interesting for both groups of scientists. The middle part (chapter “Theoretical Principles of Fluorescence Spectroscopy” and partly also chapter “Historical Perspective of Advances in Fluorescence Research on Polymer Systems”) provides a brief overview on fluorescence techniques and outlines information relevant for studies of both low- and high-molar mass systems. This part can serve as an introductory (textbook-like) chapter for polymer scientists interested in learning more about the theoretical basis of fluorescence spectroscopy. The last part contains several review articles on the application of various fluorescence techniques for studying specific aspects of the behavior of polymer solutions. We would like to stress that the book is focused on synthetic polymers and particularly on their conformational and self-assembling behavior in dilute solutions. We deliberately avoided biopolymer systems. The functional systems of biologically important polymers are very important, and their behavior is in many respects similar to that of the systems of synthetic polymers discussed here. However, other excellent books have already been published on this topic (including in this series).

In summary, the book is intended to attract the interest of polymer scientists, as well as that of experts in fluorescence spectroscopy, to facilitate their communication, help in their cooperation, and provide useful information for both communities.

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