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book review

Scattering Methods in Polymer Science

R. W. Richards (Ed.)
Ellis Horwood Series in Polymer Science and Technology
225 pages, £59.95
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Scientists working with polymers, whether they be in academia or in an industrial laboratory, are unlikely to avoid coming across the use of scattered waves or particles to characterize their systems. They will either need to apply such techniques directly, or to supervise others using them, or simply to understand reports of results in the literature. If their main interest is synthesis, then characterization of molecular microstructure, molecular weight (and molecular-weight distribution) will be essential in order to understand the success or failure of the synthetic routes adopted. Those whose work falls into the category of materials science will need to know about molecular shapes and organization in solutions and melts, as well as about phase structure, crystallinity and general morphology of prepared materials. The key techniques for studying molecular shape, size and structure and organization are light, X-ray and neutron scattering. In addition, if the polymers of interest are arranged on surfaces or at interfaces, or one is particularly interested in changes at the surfaces of bulk samples, ion beam analysis must be added to the list.

The literature is full of reports of results obtained when one or some of these techniques are applied to studying problems in polymer science. There are also, in most areas, numbers of reviews, collecting together these reports, either correlating applications of many techniques to a small group of problems, or addressing the use of one technique to study a range of problems. What these reviews often lack, however, is a clear and simple description of the techniques themselves and a critical look at how the data can be analysed and interpreted. The reviews are, moreover, scattered through the literature and can be difficult to locate. There is, therefore, an immediate appeal from a title such as 'Scattering Methods in Polymer Science'. A single reference work on the library shelf which gives introductory information on the whole range of key techniques, and provides a way into the literature for each, is very attractive. How does Professor Richards' book measure up then?

First, it looks and feels good (not a negligible consideration) and, secondly, he has collected a group of authors all of whom are experts in the fields they present. Inevitably, in an edited work such as this, there are differences in style and emphasis. Some of the authors (Gabryś on quasi-elastic neutron scattering and Vickers on wide-angle X-ray scattering) give us considerable detail about what the apparatus actually looks like and how it is set up. Others are content with outline diagrams, while Thomas on neutron reflection concentrates all his efforts on the analysis and interpretation of data. The key question is, however, does the book work for a beginner? The consensus from my research students was 'yes'. 'Not too many equations' and 'Good introduction' were phrases used. I could use myself as a guinea-pig beginner for the chapters on WAXS (Vickers) and ion beam analysis (Green and Doyle). My response was the same as my students. I found both chapters to be useful introductions to techniques with which I am not familiar.

So, what are the negatives? By far the most important from my perspective and that of my group was the inexplicable omission of small-angle neutron scattering and small-angle X-ray scattering. The editor's comments that many reviews of the former have recently been published, and that the latter is just like low-angle laser light scattering, does not, I think, convince me that the book would not have been more complete, and therefore more useful, for their inclusion.

However, not to finish on a negative note, despite these omissions this book is a very useful addition to the reference shelf for polymer scientists and one I am glad to own.

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