Book Reviews

Applications of a Technique

Mössbauer Spectroscopy. N. N. GREENWOOD and T. C. GIBB. Chapman and Hall, London, 1972 (U.S. distributor, Barnes and Noble, New York). xii, 660 pp., illus. $38.50.

A sample of lunar material as detected by a Mössbauer spectrometer provides the pattern for the dust jacket of this book, and with it also gives us a rather striking indication of how far this research area has extended since its inception with Rudolph Mössbauer's discovery of the phenomenon of recoil-free resonance fluorescence 15 years ago. Only infrequently is one privileged to observe a particular discovery in one field of study lead to proliferating developments in various quite different areas, but these interesting interdisciplinary crossings-over and growth phenomena have been relatively easy to follow in the case of the Mössbauer effect. This phenomenon, originally in the province of the low-energy nuclear physicist, has provided the basis of the now burgeoning field of Mössbauer spectroscopy (or nuclear gamma resonance spectroscopy), the subject of this new comprehensive volume.

It should be stated at the outset that, the title notwithstanding, this is not strictly speaking a general book on Mössbauer spectroscopy; rather, the orientation is toward applications in chemistry. The fundamentals of Mössbauer spectroscopy are reviewed in a thorough, useful, and readable fashion in the first three chapters, which provide an introduction to the Mössbauer effect, outline experimental techniques, and discuss hyperfine interactions. The following chapter contains discussion of applications in various other fields including relativity, nuclear physics, and solid state physics. The remainder of the book, which is by far the major portion, summarizes the wealth of experimental and theoretical results that have been obtained by the use of Mössbauer spectroscopy during the last decade. As might be expected by workers in the field, this portion of the book is organized with respect to the elements or specific nuclides exhibiting resonances, and further according to the types of chemical compounds examined. To the tremendous extent and detailed coverage undertaken by the authors may be ascribed at least in part the fact that in some cases the topical discussions are summarized largely from the original publications, without as thorough a critical review and updating as might be desired.

The authors express in the preface their hope that this book will serve both as an introductory text for those wishing to become familiar with the technique and as a detailed source book of references and ideas for those actively working in the field. The latter objective is met admirably, but only the first several chapters of this rather comprehensive book provide reasonably condensed textbook-type material, and in my opinion the cost of the book practically precludes its use as a formal text.

The book is well produced, attractively printed, and the illustrations, which are taken mainly from the original literature, are of good quality. The book incorporates references providing extensive coverage of the primary literature up to and including some 1970 publications. As the literature in this field is so widely dispersed through a vast number of domestic and foreign journals as well as many hardback volumes, the fact that this new book is so well referenced contributes to making it a valuable addition to the specialist's library.

Greenwood and Gibb's *Mössbauer Spectroscopy* will certainly become a standard work on the subject, and it is a volume which most scientists with a serious interest in Mössbauer spectroscopy will want to own.

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The Excluded-Volume Effect

Modern Theory of Polymer Solutions. HIROMI YAMAKAWA. Harper and Row, New York, 1971. xvi, 420 pp., illus. $19.95. Harper's Chemistry Series.

Polymeric systems have afforded the statistical mechanician one of his richest fields of study, and the mixture of sophisticated theory and confrontation with experiment that characterizes this field is amply demonstrated in Yamakawa's monograph.

Against the vast panorama of current interest in polymer theory, the work must be described as of fairly limited but frankly declared scope. The dimensional, thermodynamic, and transport properties of chain polymer molecules in dilute solution mark the field of interest. And in that field the excluded-volume effect is the most prominent topic.

The excluded-volume effect on many dilute-solution properties may be made to vanish with a proper choice of solvent (the "theta" solvent), since the short-range repulsion between polymer segments that gives rise to excluded-volume effects may be compensated by a net attraction at slightly longer range. The theory of polymer dimensions in this situation is a prerequisite to the study of more complicated ones, and Yamakawa provides a valuable review. Although on the whole this area is not treated nearly so extensively as in the books by Volkenstein and Flory, some aspects (such as the worm model) are treated more extensively, and in a wider context of application.

Yamakawa attempts a comparative review of the major theoretical approaches to the excluded-volume effect and succeeds remarkably well. But even in the simplest aspect of the problem, the excluded-volume effect on equilibrium dimensions, the vast variety of attacks offered by the theoretical community, and the still-unsettled nature of this tantalizing problem, mark the work as an interim report rather than a eulogy. Nevertheless, if the standard of a rigorous and analytic approach is put aside, a fairly satisfactory semiquantitative understanding is available.

The compounding of excluded-volume and realistic backbone potentials with hydrodynamic interactions in the theory of relaxation and transport properties leads to an extremely complex theory in which not all the effects have been reliably sorted out. Highly flexible chains in a theta solvent, with a poten-