

usually appreciate that after an introduction many will need to go on to more detailed treatments and the necessary references and suggestions for further reading are included. In any textbook which attempts to bring together relevant aspects of meteorology, physics and chemistry the choice of material must inevitably be arbitrary and some readers will find the book contains less chemistry and rather more physics and meteorology than they might have expected. The title is, in fact, somewhat misleading and would be improved if the word "chemistry" in it were changed to "science".

The authors' claim that the book could be used as a reference text by workers in atmospheric chemistry is rather optimistic and at variance with the aims and achievement of what is essentially an introductory course. Similarly the use of the text by research workers new to the field of atmospheric science will be limited to the acquisition of a useful introduction and an indication of where more detailed treatments may be found.

The usefulness of some of the early chapters of the book as a text for teaching will depend to a large extent on the student's experience. The study of atmospheric science would probably fit best into the later stages of an undergraduate course and the summary of chemical principles in chapter 2 may well have been covered in much greater (and necessary) detail by that stage. The modern student would probably appreciate more detailed treatment of topics of contemporary interest such as heavy metals, halogens and the upper atmosphere, and the authors should consider their inclusion in future editions of this useful introductory text.

W. S. CLOUGH

¹³C Spectroscopy

Carbon-13 NMR Spectroscopy. By J. B. Stothers. Pp. xi+559. (Academic: New York and London, November 1972.) \$24.

THIS book, written by an author who is well known for his ¹³C n.m.r. work, is intended for organic chemists and others of graduate and research worker levels. Because the full potential of the ¹³C n.m.r. techniques are just beginning to be exploited this book makes a timely and welcome appearance. Fourier transform n.m.r. spectrometers which are particularly useful for ¹³C n.m.r. studies are now commercially available.

The book starts off with a short introductory chapter on the underlying theory and also makes a useful comparison with the well known proton method.

This is followed by part 1, the first of four self-contained parts which consists of a chapter on the experimental measurement of ¹³C parameters by both direct and indirect methods, and a discussion of their advantages and limitations is given. The statement that "pulse techniques will no doubt become popular" (page 19) seems to date the book somewhat. This no doubt reflects the surge forward in n.m.r. instrumentation during the time lapse which has occurred between writing and publication of the book.

The main part, part 2 (six chapters) consists of an extremely useful and comprehensive survey of ¹³C n.m.r. shielding data covering the literature to mid-1970 in which all the shieldings are given relative to tetramethylsilane (with increasing positive numbers to lower fields). Data are presented for hydrocarbons and substituted hydrocarbons, organometallic compounds, carbonium ions, heterocyclic systems, carbonyl carbons and nitriles. In addition the current theoretical interpretations of the trends observed are discussed. This section helps to pinpoint those areas in which much further ¹³C shielding data is required (for example for organometallic, sulphur and silicon compounds).

Part 3 (two chapters) considers the experimental determination together with the theoretical aspects of ¹³C spin-spin coupling constants. A survey of mainly ¹³C-H; ¹³C-¹⁹F and ¹³C-¹³C interactions is given which is not claimed to be comprehensive, because as the author rightly points out, the literature of even one bond ¹³C couplings is enormous. More emphasis is placed on interactions over two or more bonds.

Part 4 (one chapter) consists almost entirely of examples using direct observation of ¹³C spectra so as to illustrate the present usefulness and the potential scope of this technique. Structural elucidations together with stereochemical assignments dealing with geometrical isomerism and conformational analysis are first considered, followed by applications involving natural products illustrated with examples from the terpene, steroid, carbohydrate, nucleoside, nucleotide, amino-acid and peptide fields. Some applications involving polymers and petroleum are also given. Finally, the use of ¹³C tracer techniques for the study of reaction-mechanisms and biosynthetic pathways and for solute-solvent interactions are discussed.

The book, which is well written and readable, contains in addition to the usual author and subject index, a useful compound index to shielding values and/or coupling constants given in the text. No research worker in the field can afford to be without this book on his laboratory shelf and I strongly recommend it to anyone interested in ¹³C spectroscopy.

R. G. REES

Internal Friction

Internal Friction of Structural Defects in Crystalline Solids. By R. De Batist. Pp. xii+477. (North-Holland: Amsterdam and London; Elsevier: New York, 1972.) Dfl. 120; \$37.50.

A VAST amount of information about the internal friction and associated properties of metals and other crystalline solids has been published during the past twenty years. This material has been reviewed in the series *Physical Acoustics*, edited by W. P. Mason, but that series contains many volumes and René De Batist correctly appreciated that there was a need for a single volume covering the techniques of internal friction measurements and their application to the study of lattice defects in crystalline solids.

The opening chapter surveys the basic properties of various structural defects; point defects and dislocations are considered in some detail while grain boundaries, domain boundaries and three-dimensional defects are briefly mentioned. Chapter 2 contains a formal description of anelasticity and a detailed discussion of relaxation phenomena, and concludes by describing a useful selection of the many different experimental techniques which have been used for measuring internal friction.

The remaining three chapters are concerned with internal friction caused by point defects, dislocations and two-dimensional defects respectively. In each case the author gives a comprehensive survey of the experimental data; this review of the experimental results is one of the most valuable features of the book. The theory of the relaxation of point defects, which is now fairly well established, is described clearly and in detail. By contrast, I was disappointed to find that recent modifications of Seeger's theory of the Bordoni peak are mentioned only briefly and qualitatively. The vibrating string model of dislocation resonance is discussed in detail, and there are useful sections on the various interaction effects between dislocations and point defects and on the application of internal friction techniques to the study of radiation damage in solids.

This book serves a valuable purpose in linking together in one volume the many aspects of internal friction which are often considered in isolation. The author has himself made valuable contributions in a range of different topics, and his experience has enabled him to select his material successfully and to discuss it in an authoritative manner. The book is well produced, with only a relatively small number of typographical errors, but it is a pity that its price is such that it may not reach the desks of all the research workers who might benefit from it. D. H. NIBLETT