Although it would be possible to expand almost every chapter in the handbook and produce a book from each (indeed Dekker produce a series of volumes in the Metal Ions in Biological Systems series) the extensive information offered in the one text is very welcomed. A related text by the same editors is: *Handbook of Toxicity of Inorganic Compounds.*

P. J. Cox

Introduction to Modern Vibrational Spectroscopy: M. Diem, Wiley, New York, 1993. Pages: xiii + 285. £49.50. ISBN 0-471-59584-5.

Despite the title, this book is aimed at those taking an advanced course on vibrational spectroscopy, which for most universities nowadays would be given at graduate rather than undergraduate level. Although some truly introductory topics such as elementary group theory and quantum mechanics are covered, they are put in for the purpose of revision of concepts which should be already familiar to the reader. Though much basic knowledge is assumed, a book at this level does seem to be lacking. This book certainly has the potential for filling this gap.

After a brief introductory chapter, the next two chapters cover elementary quantum mechanics and the theory of vibrational and rotational spectroscopy. The coverage of introductory material in Chapters 1–4 is probably about right. Chapter 3 covers normal coordinate analysis, including the traditional force fields (Generalised Valence and Urey-Bradley), and also mentions the tremendous potential offered by *ab initio* calculations. This chapter has a reference list for further reading, but the author omits to mention some British books which are very useful in this area, in particular L.A. Woodward's *Introduction to the Theory of Molecular Vibrations and Vibrational Spectroscopy* (OUP) and P. Gans' *Vibrating Molecules*. Both of these are strong on the use of normal coordinate analysis, and Gans' book in particular is useful for the computational aspects.

Group theory is somewhat rapidly covered in Chapter 4; for those requiring a step-by-step approach we would recommend Kettle's book, *Symmetry and Structure*. Raman spectroscopy is covered in Chapter 5, and here there is some problem with balance. SERS and FT-Raman, for example, each merit only one page of discussion. This chapter also discusses detailed apparatus for the non-linear techniques, which seems out of place before the basic instrumentation is discussed in Chapter 6. Several small molecule 'case studies' are presented in the next chapter, possibly the most valuable chapter in the book from the point of view of the newcomer to the detailed interpretation of spectra and normal coordinate analysis.

In a book such as this it is probably impossible or unsatisfactory to cover the multitude of applications of vibrational spectroscopy. So do not be too shocked to find that, for example, the applications to polymers and catalysts receive no mention. Instead, the author chooses to concentrate on his research interests in the 'biophysical' applications of vibrational spectroscopy. The molecules discussed include peptides, DNA and lipids; there is also limited coverage of the Resonance Raman of haems and carotenoid proteins. This chapter is very successful, and will be extremely useful for those research groups working in the area. It seems likely that these techniques can usefully complement the new powerful NMR methods of protein structure analysis. This is followed by a chapter on vibrational circular dichroism, also of interest in peptide spectroscopy. The technique has not yet gained popularity, since it requires highly specialised apparatus. The reader is brought right up to date in the area, but inevitably the book ends rather abruptly on an indecisive note, involving a discussion of interpretation.

Sadly, the book is littered with typographical errors, including unfortunate errors in many of the equations. There are also errors in the treatment of various topics: for example, on page 102 the OH asymmetric stretch is incorrectly derived as B_1 rather than B_2. Here, as elsewhere, the greater use of diagrams would have helped to get over concepts and illustrate the applications. Also the style is irritating in parts; for example, three consecutive sentences occur each beginning with 'however'. Such problems should have been discovered during preparation, but the author should be encouraged to prepare a revised edition.

J. A. Crayston and A. P. Taylor

Chemical Thermodynamics for Earth Scientists: P. Fletcher, Longman, Harlow, 1993. Pages xv + 464. £24.99. Softback. ISBN 0-582-06435-X.

This is a well written and nicely structured book which provides an excellent coverage of thermodynamics and its applications. As is usual of books of this type, definitions of basic terms and brief examples of straightforward concepts (such as equilibrium and the phase rule) are provided in the early stages to encourage the reader. More detailed arguments are developed later but unlike many thermodynamic texts, it is possible to explore topics in later sections without having to constantly refer back to preceeding chapters for essential derivations. Another positive feature of the author's style is the use of explanatory 'boxes', often for more detailed mathematical treatments. This allows the reader to follow a principle in the main text without being diverted by rigorous mathematical proofs.

The book begins with short introductions to system properties, bonding, solids and aqueous solutions. Ion interactions in solution are nicely dealt with in Chapter 4 as are the P-V-T properties of gases (Chapter 5). However, the early introductory chapter on redox reactions is short and might be better placed as part of the later chapter (Chapter 17) on electrochemical systems and redox. The fundamental topics, energy, thermodynamic equilibrium, thermodynamic laws and the excess functions due to mixing are described in Chapters 7 to 10. The section on phase transitions and phase equilibria provides a thermodynamic interpretation of phase diagrams for azeotropic systems leading into a treatment of ternary diagrams. There is a comprehensive section on the properties of liquid water (Chapter 13) and on the thermodynamic properties of aqueous electrolytes and non-ideality (Chapter 14).

I found the breadth and detail of topics to be about right for undergraduate students of geochemistry, soil science and environmental chemistry, the disciplines targetted by the author. The emphasis of subject matter is also appropriate to general chemistry students. Difficult topics are often explained with simple analogies. The methodology in most cases is clear and concise with ample reference to original work where appropriate. In particular, it was pleasing to see sections devoted to 'predominance diagrams' and computer-based modelling of chemical equilibria in aqueous systems (Chapters 18 and 19). These topics are currently applied in prediction of groundwater chemistry and in environmental management and are likely to experience wider application in the future.

Overall, the text is nicely balanced and supported by clear and informative figures and tables of physical data. I believe that this will be recognised by students of chemical thermodynamics as an authoritative and readable text.

D. MACPHEE

Physics Chemistry and Technology of Solid State Gas Sensor Devices: A. MANDELIS and C. CHRISTOFIDES, Wiley, Chichester, 1993. Pages xxiii + 323. $58.00. ISBN 0-471-55885-0.

This book emphasises the basics of solid state sensor devices. It is highly recommended as a text book on this subject. The fundamental physics and chemistry of the detection mechanisms of the most important solid state gas sensor devices is given. Therefore this book gives the reader the opportunity to learn a really cross disciplinary scientific subject. The book can be recommended both as a text book for class room use or for self studies.

Semiconductor gas sensors, optical sensors, quartz crystal microbalances, surface acoustic wave sensors and finally pyroelectric sensors are covered in different chapters. The development and history is given for each kind of sensor. Advantages as well as limiting aspects are mentioned. The semiconductor gas sensors are the most diversified kind of sensors and this chapter describes gas sensors based on the field effect, such as capacitors, transistors and MIS diodes as well as semiconducting sensors where the gas induces a change in conductivity. Taguchi sensors and the zinc dioxide sensors are the most common examples of these kind of sensors, though many others are also described. The outline of the chapter stresses similarities and differences in a very good way between this fairly wide range of different sensors. Chapters four and five cover photonic, photoacoustic and fiber-optic sensors and again the layout gives both a good understanding of the different sensor principles and also a good comparison between different kinds of optical gas sensors. Chapter six deals with the quartz crystal microbalance sensors for gas detection. Surface acoustic wave sensors are covered in the next chapter and finally in chapter eight the pyroelectric gas sensors are described and discussed in a thorough way.

In chapter two the physics and chemistry of interaction of gases with surfaces is described from a catalytic point of view. The authors focus on hydrogen as a model gas molecule. In the last chapter a comparison of the hydrogen response of the solid state gas sensors is given. Hydrogen is the most commonly used test gas in the development of solid state sensors and hence the interaction with hydrogen is very suitable for a comparison of different kinds of solid state sensors.

A. SPETZ