Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

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Matrix isolation spectroscopy. By A. J. BARNES, W. J. ORVILLE-THOMAS, A. MÜLLER and R. GAUFRÉS. Pp. x + 605. Dordrecht, Boston, London: D. Reidel, 1981. Price Dfl 160, US $69.50.

This voluminous book is an edited collection of lectures and discussions at the NATO Advanced Study Institute held in France in July 1980. Though the matrix isolation spectroscopy (MIS) technique may be unfamiliar to the crystallographer, those who read even half of this publication will become well acquainted with the technique and readily recognize its usefulness. The MIS technique is one way to study the structure and interactions of solute isolated in an appropriate rare-gas matrix or large cage molecules like adamantane by various methods: IR/Raman, electronic, ESR, and Mössbauer spectroscopy.

Although this book is a collection of lectures by various authors, it has detailed references and an adequate index. This book is composed of three sections: *Technqiue*, *Matrix effect*, and *Applications*. In section 1, the historical progress in MIS and the technical problems in applying each spectroscopic method are stated in detail in a way which is very understandable for those not well acquainted with MIS. Further, the method for time and frequency-resolved vibrational spectroscopy using the latest laser technique is touched on briefly. The methods for studying stable and unstable molecules trapped in a matrix, and precautions which beginners often fail to take, are included in the experimental discussions. Additionally, high-pressure studies and adducts (complexes) are treated briefly. Reading through the first section gives a good overview of MIS.

In section 2, interpretation of the matrix-isolated species and its behavior are treated theoretically. Experimental evidence for spectral changes, in the different spectroscopic methods, which arise because of matrix isolation (matrix effects), are discussed in comparison with theoretical models. This section is a necessity for spectroscopists in each field for the practical analysis of spectra of matrix-isolated species.

In section 3, the structures and properties of matrix-isolated atoms, their aggregates, ternary oxides, and transition-metal compounds are discussed using electronic and IR/Raman spectroscopies. The generation reaction and interconversion of metal compounds by photolysis in the matrix, which are closely related to photochemical and biochemical reactions, are discussed through IR/Raman spectra. Two interesting applications of MIS are to clarify the bonding nature of hydrogen-bonded species and to determine conformations among isomers which have small energy differences between each other by using the inherent property of the sharpness of the matrix-isolated spectrum peak which is free from hot band and rotation.

There are probably more applications for MIS study than we can imagine. In the field of catalytic reactions of metals and metal oxides, for example, 'it can be argued that if more was known about the structures and bonding of the reaction intermediates by MIS, this would lead to a better understanding of reaction pathways and perhaps to the ability to direct and control the courses of chemical reactions'.

To point out one deficiency in this book, some figure explanations are insufficient, especially in the latter half of the book.

Any scientist interested in matrix isolation spectroscopy should read this book to get a basic understanding of MIS and a knowledge of its up-to-date and wide range of applications.

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Dynamical properties of solids. Vol. 3. Metals, superconductors, magnetic materials, liquids. Edited by G. K. HORTON and A. A. MARADUDIN. Pp. vii + 333. Amsterdam: North Holland, 1980. Price US $58.50, Dfl. 120.00.

In Volume 1 of this series the editors predicted a three-volume series, with non-crystalline solids to be covered in Volume 3. Apparently there are more essentials to be written on dynamical properties of solids than the editors originally envisaged – the present volume deals mainly with crystalline solids and the non-crystalline solids have been deferred to a fourth volume, reviewed below.

Volume 3 contains four contributions: *Phonons in transition metals* by S. K. Sinha; *Phonons and the superconducting transition temperature* by P. B. Allen; *Spectroscopy of collective pair excitations* by P. A. Fleury; *Interaction of magnetic ions with phonons* by B. Lüthi.

With the chapter by Sinha on phonons in transition metals the most common types of crystalline solids have been covered in this series. The paper discusses the 'anomalies' often observed in the phonon dispersion curves of transition metals and their relation to phase transitions, in particular to the occurrence of high superconducting transition temperatures. The latter is also the main topic of Allen's chapter and hence some overlap results – an almost unavoidable consequence of multiple authorship. The chapter reviews briefly the theory of superconducting transition temperabearing on the relation between phonon properties and superconducting transition temperatures.