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Book review

Vibrational Spectroscopy — Modern Trends, edited by A.J. Barnes and W.J. Orville-Thomas, Elsevier Scientific Publishing Company, Amsterdam and New York, 1977, XIV + 442 pages, Price: US $49.95, ISBN 0-444-41632-3.

In the recent past important advances in technology, particularly the development of lasers and microprocessors, have ushered in a new era in vibrational spectroscopy. Extremely accurate, sensitive and reliable instruments which are capable of high resolution in a wide spectral range, now make it possible to perform many kinds of experiments which could not have been studied in the classical period of infrared spectroscopy. This book has been written with the intention of surveying these recent developments in both infrared and Raman spectroscopy, and to illustrate where these techniques have made the greatest contributions to studies of molecular structure and molecular behavior.

The book is ordered into four parts. Part A deals with lasers and their applications (Principles of Lasers; Non-linear Raman Effects; Infrared Fluorescence; Tunable Infrared Lasers). Part B describes experimental methods (Fourier Transform Spectroscopy; Matrix Isolation; Techniques for Studying Highly Reactive and Unstable Species; Techniques for Studying High Temperature Species; Trace Analysis by Infrared Spectroscopy; Resonance Raman Spectroscopy). Part C concentrates on some theoretical methods (Isotopic Substitution; Infrared Band Intensities and the Polar Properties of Molecules; Prediction of Infrared and Raman Intensities by Parametric Methods; Band Contour Analysis; Some Comments on the Use of Constraints and Additional Data besides Frequencies in Force Constant Calculations; Limitations of Force Constant Calculations for Large Molecules; Atom—Atom and Dipole—Dipole Intermolecular Potentials in the Lattice Dynamics of Molecular Crystals). Part D, finally, presents a number of applications to problems in molecular structure (Vibrational Spectra of Solids; Determination of Barriers to Internal Rotation about Single Bonds; Vibrational Spectra of Transition Metal Coordination Compounds and their Analysis; Vibrational Spectra of Metal Carbonyls; Intra- and Intermolecular Vibrations of n-Alkanes and Polyethylene; Molecular Dynamics and Vibrational Spectra of Polymers; Raman Spectroscopy of Nucleic Acids and Proteins; Resonance Raman Spectra and Normal Coordinate Analysis of Some Model Compounds of Heme Proteins).

This is really a very interesting book. The renaissance of vibrational spectroscopy in the last decade or so has been so spectacular that it is absolutely fascinating to read this survey of some of the most advanced applications of this technique. The book was not meant to be exhaustive and the number of pages of each chapter was restricted. But the presentations are usually clear and a clever selection of topics was made, even though a number of descriptions of some of the conventional applications of vibrational spectroscopy to molecular structure might as well have been omitted.

Many of the areas described have so far been a domain of physicists. To scientists interested in applications to chemistry, it is a particular advantage of the book that some of the phenomena (for example CARS) are also described by using symbols with which chemists are familiar.

In view of the many marvellous experiments described in this book it is important to keep in mind that vibrational spectroscopy is a relatively poor technique for the full determination of molecular structures. The structural evidence which this method provides is essentially circumstantial and often incomplete and the results of a study often depend on rather subjective interpretations of observables. In some of the chapters, for example the one on matrix isolation, the authors do an excellent job to point out the dangers and potential sources of errors which in the past have led to a number of misleading conclusions. In other chapters one might have wished for a more urgent warning than is actually presented to protect potential users.

Apart from some trivialities (a nearly useless author index and a not much more useful index of keywords) this reporter has no complaint concerning this book. I recommend it strongly as an excellent source of key references and as a valuable introduction to the recent advances in a rapidly expanding area of important research. I am sure that every scientist whose activities are somehow involved with vibrational spectroscopy will find this a very useful volume.

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Erratum

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Page C17, line 5 of the 2nd paragraph should read:

Strukturfaktoren ($I > 3.5\ \sigma$). Die Struktur wurde mit Hilfe konventioneller Schwer-