Vibrational Spectroscopy: Theory and Applications. D. N. Sathyanarayana. New Age International Pvt Ltd. 4835/24, Ansari Road, Daryaganj, New Delhi 110 002. Price: Rs 750. 715 pp.

The two complementary vibrational spectroscopic methods, viz. infrared and Raman spectroscopy are essential for the study of polyatomic molecules and crystalline solids. Vibrational spectroscopy is an interdisciplinary subject covering physics, chemistry, biology, geology, material science, bio-physics, bio-chemistry, biotechnology, forensic science, etc. It provides information about various kinds of molecular interactions. The determination of strength of the hydrogen bond is a particularly important field of application of vibrational spectroscopy. Polarized spectra help to determine the positions of the ions and molecules in the unit cell. Phase transitions can be detected by measuring the temperature dependence of vibrational spectra. The thermodynamic properties such as heat content, free energy, entropy and heat capacity can be determined through vibrational spectroscopic data. Thermodynamic properties have practical importance since it is difficult or sometimes even impossible to measure these quantities experimentally. If the experimentally-observed frequencies are available for the polyatomic molecule, it is possible to evaluate all the thermodynamic properties. The properties calculated are the combined translational, rotational and vibrational contributions. These properties are useful to material scientists and industries.

The intensity studies on the vibrational spectra throw light on the nature of the structure, intermolecular forces, effect of temperature, conjugation, substitution, positional isomerism and solvents.

Due to industrial problems of increasing complexity, rapid advances took place in IR and Raman spectroscopies. The biggest factors in these advances are lasers and computerization. Vibrational spectroscopic microprobes became popular in recent years. The samples for microprobe analysis are homogeneous, exhibiting inclusions, phase segregation, bubbles, impurities, catalysts, corrosion, minerals, polymers, ferrography, fossil fuels, environmental samples, photo voltaic devices and ceramic materials. The spectroscopic interest in ceramic fibres and polymers is becoming more and more important in the present age.

The introduction of Fourier transform infrared and Raman spectroscopy created a big revolution in vibrational spectroscopy owing to its high resolution and other advantages. Fluorescence from electronic transitions occurring from laser frequency is many times stronger than Raman scattering. Further, conventional Raman spectroscopies use high power lasers which require large power supplies, chillers, etc. Fourier transform Raman with exciting frequency in the near IR spectral region (Nd : YAG laser – 1.064 micrometers) removed all the above difficulties. Thus the FTR spectroscopic techniques provide useful information for a large number of industries such as polymers, chemical catalysts, petroleum, coal, pharmaceuticals, cosmetics, health care and paper industries.

The use of high power lasers opened a new spectroscopic area, namely nonlinear spectroscopy. Harmonic generation stimulated Brillouin scattering, stimulated Raman effect, hyper Raman effect, phase conjugation and coherent antistokes Raman effect are a few examples of nonlinear spectroscopy. These nonlinear effects frequently have strongly directional characteristics because optical media are generally dispersive and often birefringent.

I have just touched the state of art of vibrational spectroscopy and on a few of many existing and new applications of vibrational spectroscopy. This area will certainly help to solve even more difficult and complicated problems in future. Hence, a book on vibrational spectroscopy covering all the above aspects at the introductory level is a good boon to the student community. The author has succeeded in this regard in his book on *Vibrational Spectroscopy*. As stated by the author, many of the topics on vibrational spectroscopy have already appeared as individual excellent books. The author's effort to unify the various topics in a single book is a good attempt. As it is not possible to cover all the areas of vibrational spectroscopy in a single book, the author has deliberately left a few important topics, which are really interesting areas in this branch of study. The book consists of three parts. Chapters 1 and 2 deal with basics of infrared spectroscopy and instrumentation, while Chapters 3 and 4 discuss essential group theory and its application to vibrational spectroscopy. The rotational spectra and vibrational spectra of diatomic and poly-atomic molecules are given in Chapters 5 and 6. All these six chapters form the first part of the book. In the second part, Raman spectroscopy is discussed briefly in Chapter 7. Although this chapter gives a brief view on nonlinear Raman effects, the important development on Fourier transfer Raman spectroscopy is missing. The third part covers structure of small molecules, application to coordination chemistry, organic compounds, spectral properties, polarization measurements and basics of normal coordinate calculations from Chapters 8 to 14. These chapters give an idea about these topics to students and cannot serve as a reference volume. The appendices will be useful to the beginners in this field.

A special feature of the book is the relevant references under each chapter along with the well-designed problems. The presentation of the material is very clear and it is a good book for self-study. Another noteworthy feature is that the book is free from errors.

The book has certainly achieved its goal of introducing the subject to the post-graduate students (M Sc) and senior under-graduate students (B Sc) of physics and chemistry. Hence, it is recommended to the students and researchers who want to explore the growing areas in vibrational spectroscopy.

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