CJASS Book Review

Reviewer: H.F. Shurvell

Professor Emeritus
Department of Chemistry, Queen's University
Kingston, Canada

Course Notes on the Interpretation of Infrared and Raman Spectra

Dana.W. Mayo, Foil. A. Miller and Robert.W. Hannah

John Wiley & Sons, Inc., Hoboken, New Jersey, 2004.
ISBN 0-471-24823-1

The book is based on the MIT-Bowdoin College summer courses on infrared spectroscopy given since 1950. The objective of the text is to bring the notes and exercises used in the course to a wider audience. A forword by Foil Miller describes the history of the MIT-Bowdoin College Summer Infrared Course from 1950-2000. The preface sets out the logical organization of the course with outlines of the contents of the chapters and exercise sections.

Most of the book is devoted to a rigorous, in-depth approach to the interpretation of infrared spectra of organic compounds. Later chapters cover the interpretation of infrared spectra of polymers, inorganic materials and mixtures. The complementary nature of infrared and Raman spectra is illustrated throughout the text by figures containing spectra of compounds obtained by both techniques presented together on the same scale.

Chapter **1** introduces topics that are used throughout the book. These include group frequencies and fingerprint frequencies, band intensity and bandwidth, some simple theory of IR and Raman spectroscopy and coupling of vibrations. Chapters 2-9 are devoted to characteristic group frequencies of alkanes (**2**), alkenes (**3**), multiple bonds (**4**), aromatic ring systems (**5**), X-H groups (**6**), carbonyl groups (**7**), amides, carboxylate ions, and C-O single bonds (**8**), groups containing –N=C bonds, Si, P, S and halogen atoms (**9**). There are chapters on infrared spectra of polymers (**10**) and inorganic materials (**11**). A survey of infrared and Raman group frequencies (**12**) emphasizes the complementary nature of IR and Raman spectra. There are also chapters on sampling (**13**) and analysis of mixtures (**14**). An extensive bibliography of the infrared and Raman literature is included.

There is probably nothing in this book that cannot be found in the numerous published texts and manuals on the interpretation of vibrational spectra. On the other hand, the book is different and the approach is novel in several ways. Information is presented in the form of notes in an organized format. The chapters contain sections (Roman numerals) divided into sub-sections (upper case letters), containing Topics (numerals), each with a list of Items (lower case letters), some of which may include notes and examples (numerals with parentheses). As an example: Chapter 3 (Characteristic Frequencies of Alkenes (Olefins)), Section II.(C=C stretch), sub-section A.(Frequency), Topic 5.(Other factors affecting the frequency), Item a. (configuration), note 3) (conjugation to phenyl).

There are progressive exercise sections at three stages of the development of the text. Exercise Section I follows Chapters 2-5, Section II follows Chapters 6-10, with problems based on Chapters 2-10 and Section III follows Chapters 11-17 and includes problems on polymers, inorganic materials and the complementary nature of IR and Raman spectra. There are 19 exercises containing 38 problems. A completely worked interpretation of the IR and Raman spectra of an unknown compound is presented in Chapter 15, and detailed answers to the exercises are given in a 38 page section following Chapter 15.

Some highlights of the book are: over 500 IR and Raman spectra, an introduction to IR spectra of polymers, which includes a useful flow chart for polymer identification, and a chapter on infrared spectra of inorganic materials, with a chart of characteristic IR frequencies for inorganic ions. The text is well organized and well written and the many spectra are clearly and consistently presented. This book should be useful to both instructors and students in courses on interpretation of infrared and (to a lesser extent) Raman spectra.