

BOOK REVIEWS

desired for a general analytical laboratory.

There are several features in this book that make its presence in an analytical laboratory extremely desirable in spite of the \$25. price. In the first place, it has 33 pages of subject index which provides easy access to all information in the volume. In the second place, not only the analytical detail but also the background of each method is precisely discussed so that understanding is simple. In the third place, while this book is described as being *micro* and *semimicro* methodology, the subject matter content is functional group analysis in general. Finally, this book clearly demonstrates that the limitation of sample size is an artificial barrier.

This book is recommended for all laboratories doing organic analysis and for laboratories in which students are receiving instruction in organic chemistry or in analytical chemistry.

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Introduction to Infrared and Raman Spectroscopy

Norman B. Colthup, American Cyanamid Co., Stamford, Connecticut, *Lawrence H. Daly*, State University of New

York, Albany, and *Stephen E. Wiberley*, Rensselaer Polytechnic Institute, Troy, New York. Academic Press, Inc., New York, 1964. xii + 511 pp. Figs. and tables. 16 × 23.5 cm. \$12.

The biggest section in our personal scientific library at the present is the spectral collection. The number of books on infrared alone has jumped from two in 1958 (West and Bellemey) to about a dozen (Potts, Rao, Allen and Cross, White, Davies, Thompson, Szymanski-2, Conn and Avery, Flett, Nakanishi and Cross). In addition, we resort to other books of a general nature such as the "Advances in Spectroscopy" series and the work by Bauman.

Undoubtedly, this need for reference works is typical and is stimulated by our desire as an infrared user to keep up with the phenomenal increase in both the theoretical and applied published literature. Selected reviews by Gore and Evans published biennially in *Analytical Chemistry* tend to run to several hundred items abstracted from the literature. The total number of spectroscopic references now runs into the many thousands each year. Users of infrared must also resort to spectral reference collections containing up to 50,000 items with more to come. The increasing availability of high performance grating spectrophotometers and current developments in Laser-Raman instrumentation are stimulating an output of higher quality work employing integrated absorption intensities and accurate frequency measurements. A greater em-

phasis is now placed on detailed analysis and interpretation and correlation with theory. Hence the need for a large spectral library in laboratories depending on infrared analysis.

It is perhaps necessary for a reviewer to classify a book on infrared as elementary, intermediate introductory, intermediate or advanced. Many of the introductory infrared texts such as the book under review have a common plan of organization as shown by comparison of tables of contents. These are an introduction, a review of technique and instrumentation, theoretical discussion, and spectra-structure correlations. Since, in spite of the rapid growth in infrared techniques in the last ten years, the work of Jones and Sandorfy and of Bellemey has dated very little and Herzberg is still a foundation work for theoretical analysis, it behooves the reviewer to carefully consider the relative merits and justifications for new introductory texts.

The "Introduction" of Colthup, Daly, and Wiberley is a worthwhile addition to the spectral library and is also a good choice for teachers, students and chemists who wish to become acquainted with either theoretical or applied analysis of molecules by infrared spectroscopy. Chapters 1, 3, 14 and 15 (vibrational and rotational spectra, classification of molecules, the theoretical analysis of molecules and the calculation of thermodynamic functions) may be read as a group for the purposes of an introduction to molecular infrared spectroscopy.

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Chapters 5 through 12 (discussions of alkanes, alkenes, aromatics, etc.) are as a group excellent both as an introduction and as a reference work for the purposes of spectra-structure correlations and practical interpretation of spectra. Correlation of group frequencies with electronic factors such as electronegativities, resonance, inductive and field effects, and hydrogen bonding are discussed in Chapter 4 and also in individual sections on group frequencies such as the section on carbonyl groups.

Chapter 4 includes a discussion of symmetry properties and the technique of calculation of character tables and the selection rules for allowable vibrational transitions in the infrared and Raman spectra. This section includes a coverage of the recent literature of small molecules. In Chapter 14 a mathematical technique for determination of frequencies from available force constants is described. Frequencies are obtained by solution of the secular determinants involving elements of the F (potential energy) and G (kinetic energy) matrices. The chloroform molecule is shown to contain six normal or fundamental vibrations. Experimentally these happen to be the most intense Raman lines. The remaining sixteen bands reported for chloroform in

the 200 to 4,000 wavenumber region are either overtones or combination bands. The agreement between observed and calculated frequencies is shown to be within 1 or 2 per cent.

Additional valuable features of this book are the inclusion of a collection of 624 selected reference spectra labelled as to band assignments and vibrational species and the illustrated sketches of various types of vibrational species by means of useful models which help the reader to visualize the spatial configurations and vibrations involved. Also useful are the numerous tables of spectra-structure correlations and a dozen spectra-structure correlation charts covering the near infrared, intermediate and far infrared regions.

The text is clear, concise and very readable. Literature citations are given at the bottom of each page where first cited. It is felt that sufficient references are given to enable the reader to delve rapidly into the most important recent literature on particular topics. The introduction is therefore a good first choice for the student or teacher and is also a welcome addition to the library of the practical analyst to take its place along with other useful reference books in the field of infrared analysis.

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The Systematic Identification of Organic Compounds: A Laboratory Manual

Ralph Shriner, Southern Methodist University, Dallas, Texas, *Reynold C. Fuson*, University of Nevada, Reno, and *David Y. Curtin*, University of Illinois, Urbana. 5th ed. John Wiley and Sons, Inc., New York, 1964. ix + 458 pp. Figs. and tables. 15.5 × 23.5 cm. \$7.75.

The appearance of the fifth edition of this well-known and widely-used text and laboratory manual on qualitative organic analysis emphasizes again the importance of this discipline in the training of chemists. The authors present their basic argument in their opening sentence of the text, "The theory and technique for identifying organic compounds constitute an essential introduction to research in organic chemistry." Furthermore, the authors hold firmly to the original objective of teaching fundamental organic chemistry. One finds in this text a remarkable union of, and balance between, the operations of fundamental organic chemistry and the proved techniques of instrumental analysis.

Although the method and approach remain essentially the same as those presented in the fourth edition, one is impressed by certain changes which add strength to the total work. The introductory chapter is much improved, with clear-cut suggestions which delineate

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