

# NEW BOOKS

edited by F. W. Quackenbush

**INFRARED SPECTROSCOPY—ITS USE IN THE COATINGS INDUSTRY**, The Infrared Spectroscopy Committee of the Chicago Society for Paint Technology (Federation of Societies for Paint Technology, Philadelphia, Pa. Publishers, 456 + x p., \$30.00).

This excellent working text is a revision of an earlier (1960) publication written as a basic introductory manual designed to guide the coatings chemist over the initial hurdle of spectroscopy and to overcome much of the reluctance of the industry to adopt infrared methods of analysis.

This new publication is a considerable up-dating of the 1960 edition and is intended to replace rather than augment the earlier volume as infrared spectrophotometers have become commercially available and are now appearing in the laboratories of many coatings companies, and infrared spectroscopists in the coatings industry have gained a degree of sophistication that is comparable to that of infrared spectroscopists in any other industry.

The first 65 pages of the text present, in six chapters, rather elementary but very well written descriptions of infrared spectrophotometry and of its use as a tool in qualitative and quantitative analytical chemistry. Chapter I presents a readily understandable description of vibrational (infrared) spectra as differentiated from other radiation in the electromagnetic spectra, with examples of how specific vibrational bands in the infrared spectra can be correlated with, and used to identify specific organic functional groups present in an analytical sample. Chapter II briefly describes infrared instrumentation and Chapter III experimental techniques, including solid state methods (cast films, hydrocarbon mulls and potassium bromide disks), liquid procedures (suitable solvent and solvent mixtures), and surface techniques by means of attenuated total and multiple internal reflectance spectra. Chapters IV and V cover the problems of application of qualitative and quantitative analyses. The first of these two chapters, assuming that "An experienced coatings chemist normally has considerable knowledge of the types of materials that are used in specific applications and will utilize this knowledge to guide the interpretation," an assumption that would appear to this reviewer to apply to the use of infrared absorption spectra by any group of analytical spectroscopists, describes in detail the use of infrared spectra for the negative or positive identification of specific or organic functional groups in the analytical sample. This description is aided by illustrations from 15 infrared absorption spectra used to demonstrate how these spectra clearly verify the absence or presence of specific organic functional groups and by the inclusion of 15 full-page infrared band frequency-organic functional group correlation charts. Chapter V discusses the basis for quantitative determinations by means of infrared spectra, including derivation of the Absorption Law, methods for correction for background, and the preparation and use of standard or working curves.

Chapter VI presents briefly selected applications in the coating industry including use of infrared spectra in chain orientation studies, in investigations of degree of crystallinity, extent of pyrolysis of polymers, curing rate and oxidation investigations, and extension of infrared methods to investigation of inorganic materials. Chapter VII is a bibliography consisting of 533 references arranged, after a first group of general references, to follow and complement the first six introductory chapters.

In the discussion of qualitative analysis by means of infrared absorption spectra, the coatings chemist is warned that "once the chemical class of the molecule has been determined, standard reference spectra should be studied before a positive identification is made." This technique has become, more and more, the standard technique of infrared qualitative analysis. Using his knowledge of the analytical sample, supplemented by any readily available

chemical tests, the analytical spectroscopist uses the band position, functional group correlations, to establish a tentative identification of the unknown, and then confirms this tentative analysis by a direct "fingerprint" matching with an authentic spectrum of the material he has tentatively identified.

Chapter VIII, the last chapter in the book, consists of 373 pages, or over 80% of the entire volume. On these pages are reproduced, in excellent standard format, 740 infrared absorption spectra of possible interest to the coatings chemist. The spectra were all obtained from a single instrument, the Beckman Model-12 Spectrophotometer, a double beam filter-grating instrument using four gratings to obtain spectra from 200 to 4000  $\text{cm}^{-1}$ . These collected data should provide the coatings chemist with about any spectrum he needs for the fingerprint matching confirmation of an unknown sample.

The book, by providing for chemists involved in analyses within the coating industries complete group frequency-functional group correlation charts, and a very adequate library of fine spectra for fingerprint matching, constitutes a volume which no one working in this field could possibly be without. It further establishes a model of the information which should be collected and made available (hopefully in as beautiful format) for scores of industries where infrared absorption spectra, in spite of the lack of such reference material, is proving to be of major assistance in solving analytical problems.

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**ANALYTICAL INSTRUMENTATION**, by Galen W. Ewing, (Plenum Press, New York, 151 p. 1966).

This book is a laboratory manual for an instrumental analysis course. It is designed primarily for use with modular instruments distributed by A.R.F. Products, Inc.

The manual is divided into five parts. Part I contains a description of each of the electrical modules. It includes a discussion of the operating theory and a circuit diagram for each module. In Part II the interconnection of the modules to form operating electroanalytical instruments is described. Included in this section are appropriate cautions about scale selection, loading a circuit with a meter, etc. The optical modules are described in Part III. Part IV consists of 17 experiments, including electrometric, thermometric and spectrophotometric. In Part V the author includes an additional 12 experiments related to instrument evaluation. This portion is designed to make students more aware of the importance of proper calibration. It also shows how data can be distorted by careless use of instruments.

All of the text material is very clear and quite readable and the experiments are well-organized. The book was obviously carefully written and has been printed well. It can be recommended wholeheartedly for courses using the modules for which the book was designed.

Who else could use this manual? This reviewer believes that any instructor whose instrumental analysis course is based on modular equipment should consider this manual. Those who are using complete instruments will find the book of less value. Supplemental instructions would need to be prepared for many of the experiments. The descriptive material could still be used nicely, however, and instructors of such courses should probably examine the manual. This book would not be very valuable for individuals who are seeking a reference or text on instrumental analysis. It is an excellent laboratory manual for the system for which it was designed, but it is a laboratory manual and not a textbook.

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