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Book Review

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Book Review

Ewing's Analytical Instrumentation Handbook, 3rd Edition, Jack Cazes, Ed., Marcel Dekker Inc., New York, 2005, 1037 pp., Price: £145.00

This is a remarkable book. The main impression it left to the reviewer is that of the completeness of the techniques used in chemical analysis.

Fifty seven authors with practical field experience have contributed to Ewing's Analytical Instrumentation Handbook, Third Edition. This book is well written and includes thirty one chapters.

The Laboratory Use of Computers, Flow Injection/Sequential Injection Analysis, Inductively Coupled Plasma Optical Emission Spectrometry, Atomic Absorption Spectrometry and Related Techniques, Ultraviolet, Visible, Near-Infrared Spectrophotometers, Molecular Fluorescence and Phosphorescence, Vibrational Spectroscopy, Instrumentation for Infrared and Raman Spectroscopy, X-Ray Methods, Photoacoustic Spectroscopy, Techniques of Chiroptical Spectroscopy, Nuclear Magnetic Resonance, Electron Paramagnetic Resonance, X-Ray Photoelectron and Auger Electron Spectroscopy, Mass Spectrometry Instrumentation, Thermoanalytical Instrumentation and Applications, Potentiometry: pH and Ion-Selective Electrodes, Voltammetry, Electrochemical Stripping Analysis, Measurement of Electrolytic Conductance, Microfluidic Lab-on-a-Chip, Biosensor Technology, Instrumentation for High-Performance Liquid Chromatography, Gas Chromatography, Supercritical Fluid Chromatography Instrumentation, Capillary Electrophoresis, Gel Permeation and Size Exclusion Chromatography, Field-Flow Fractionation, Instrumentation for Countercurrent Chromatography, HPLC-Hyphenated Techniques, Thin Layer Chromatography and Validation of Chromatographic Methods are the thirty one chapters.

The Handbook serves as a guide for students, undergraduate and postgraduate, for researchers and scientists in the field of Analytical Chemistry. It is a reference book for the recent analytical chemistry techniques. We can find information about a specific technique and references dealing with theory and methodology of those techniques as well.

The chapters which appeared in the previous edition have been updated and expanded, with concepts, applications, and key references to the recent literature. The book includes eight new chapters dealing with: Microchip

Technology, Biosensor Technology, Validation of Chromatographic Methods, Gel Permeation and Size Exclusion Chromatography, Field-Flow Fractionation, Countercurrent Chromatography, including LC-MS, LC-NMR, etc., and Thin-Layer Chromatography.

This book is a valuable new source of information describing the latest developments in analytical techniques for scientists working within the field of analytical chemistry.

The editor has been successful in arranging the chapters in a logical order and establishing a satisfactory balance and conformity among them.

The book is free from typographical errors, the text is adequately illustrated and chapter titles are accurate. This volume will serve as an up to date reference book and will be a very useful guide for analysts. Furthermore, it can be recommended as a valuable new source of information to scientists working within the field of Analytical Chemistry.

Every chapter begins with an introduction about the techniques and the properties of the components which can be analyzed with the individual techniques.

The first chapter describes the laboratory use of computers. Today, all the analytical instruments are combined with computers for peak area evaluation and automated data storage. In this chapter, the computer components and design considerations, the computer/instrument interfaces, data analysis/chemometrics, and data organization and storage are presented.

The second chapter deals with flow injection/sequential injection analysis. It describes the techniques, gives the developments of the techniques and presents selected applications and hyphenations in on-line sample pretreatments.

The third chapter describes inductively coupled plasma optical emission spectrometry. In this chapter, an overview is given for the technique and the description of the principles, instrumentation, and applications is demonstrated.

The fourth chapter deals with atomic absorption spectrometry and related techniques. The history of atomic spectroscopy, the atomic spectra in absorption, emission, and fluorescence, the instrumentation and the techniques of atomic spectroscopy are presented.

The fifth chapter describes ultraviolet visible and near infrared spectrophotometers. Beer's law and the deviations from Beer's law are presented. Also, the characteristics, the present and the future of ultraviolet, visible and near infrared spectrometry are presented.

The sixth chapter deals with molecular fluorescence and phosphorescence. The theory, the instrumentation, and the practical consideration and applications of molecular fluorescence are given.

The seventh chapter covers vibrational spectroscopy, instrumentation for infrared and Raman spectroscopy. The practical issues of implementation of infrared and Raman instruments, the instrumentation standards, and the recommended reference sources are presented.

The eighth chapter discusses x-ray methodology. Conventional x-ray diffraction, x-ray fluorescence, and surface x-ray methods are presented. Also, an additional reading for x-ray properties of elements, diffraction, detectors, emission, fluorescence, photoelectron spectroscopy, reflection, and microanalysis is given.

The ninth chapter presents photoacoustic spectroscopy. Photoacoustics and photoacoustic spectroscopy, history, and principles are given. The reference of photoacoustics to plant science, a review of photoacoustic applications in the plant sciences, and photoacoustic in detection of plant diseases are presented.

The tenth chapter deals with techniques of chiroptical spectroscopy. Polarization properties of light, optical rotation, and optical rotatory dispersion, circular dichroism, circularly polarized luminescence spectroscopy, vibrational optical activity, and fluorescence detected circular dichroism are presented.

The eleventh chapter discusses nuclear magnetic resonance. Instrumentation design, theoretical background, the experimental methods for NMR and data analysis interpretation are presented.

The twelfth chapter describes electron paramagnetic resonance. It provides the reader with information about: an electron paramagnetic measurement, electroparamagnetic spectrometer, the sample quantitative measurements of spin density, guidance on experimental technique, less common measurements with electromagnetic spectrometers, and reporting results.

The thirteenth chapter discusses x-ray photoelectron and Auger electron spectroscopy design, interpretation of photoelectron and Auger spectra, compositional depth profiling, and areas of application and other similar methods are presented.

The fourteenth chapter deals with mass spectrometry instrumentation. Ionization methods, such as: matrix-assisted laser desorption/ionization, electrospray ionization are provided. Mass analyzers, such as: triple quadrupole mass spectrometer, time-of-flight mass spectrometer, quadrupole time-of-flight mass spectrometer, Fourier transform ion cyclotron resonance mass spectrometry, surface-enhanced layer desorption/ionization time-of-flight mass spectrometry, and inductively coupled plasma mass spectrometers are discussed.

The fifteenth chapter describes thermoanalytical instrumentation and applications. In this part of the book, details are given for thermogravimetry, thermogravimetric analysis, derivative thermogravimetry, differential thermal analysis, differential scanning calorimetry, evolved gas analysis, thermo-mechanical methods, dielectric thermal analysis, calorimetry and micro calorimetric measurements. Also, other techniques, such as thermoelectrometry, high-resolution thermal analysis, simultaneous thermal analysis techniques, and some less common techniques: Optical spectrometric x-ray, differential thermal analysis-rheometry, micro thermal analysis, and applications of these techniques are given.

The sixteenth chapter deals with potentiometry, pH, and ion selective electrodes. Details for reference electrodes, indicator electrodes, general instrumentation for potentiometers, direct reading instruments, commercial instrumentation, applications of the techniques, and current research activities are presented.

The seventeenth chapter describes the technique of voltammetry. This chapter includes the general instrumentation, the oxidation/reduction, polarization, the voltammogram, mass-transport, the diffusion layer, the Faradaic current, the non-Faradaic current, the voltage/time/current interdependence, cyclic voltammetry, polarography, the waveforms, innovative applications of voltammetry, suppliers of analytical instrumentation and voltammetry simulation software.

The eighteenth chapter discusses electrochemical stripping analysis. In this part of the book, information is given about anodic stripping voltammetry, cathodic stripping voltammetry, stripping chromopotentiometry, adsorptive stripping voltammetry, and stripping tensammetry. Also, instrumentation and applications of electrochemical stripping analysis are presented.

The nineteenth chapter deals with the measurement of electrolytic conductance. Principles of the technique, immersed electrode measurements, and electrodeless measurements are provided.

The twentieth chapter deals with the microfluidic lab-on-a-chip. In this chapter, the micromachining methods, microfluidic flow, sample introduction, sample preconcentration, and separation and detection methods are presented. Also, applications to cellular analysis, to DNA analysis, and to protein analysis are presented.

The twenty first chapter deals with biosensor technology. Biological materials, transducers, immobilization procedures of biological materials, design of storage life, array based biosensors and design of flow injection analysis/biosensors and sequential injection are presented.

The twenty second chapter describes the technique of high-performance liquid chromatography. The chapter is divided into three parts. In the first part, the plate theory, molecular interactions, a thermodynamic explanation of retention and control of retention by stationary phase availability are described. In the second part, the instrumentation of the high performance liquid chromatography is presented. In the final part of the chapter, the complete modern chromatography is presented. This includes the hyphenation of liquid chromatography to mass spectrometry, which is the state of the art for the technique.

The twenty third chapter presents gas chromatography. This chapter is divided into twelve subchapters, where all the data for the technique are given. Gas chromatography is well presented and the recent developments for fast gas chromatography, for portable gas chromatography, and on-line liquid chromatography and gas chromatography are given.

The twenty fourth chapter deals with the instrumentation of supercritical fluid chromatography. In this chapter, the instrumentation of supercritical fluid

chromatography, method development, hyphenation of supercritical fluid chromatography with mass spectrometry, solute derivatization, and chiral supercritical fluid chromatography are presented.

The twenty fifth chapter discusses capillary electrophoresis. The theory, the modes, the instrumentation, data integration, sample preparation, method development and optimization, methods validation, and applications of capillary electrophoresis are discussed.

The twenty sixth chapter describes gel permeation and size exclusion chromatography. In this chapter, the basic concepts, concentration detectors and molar mass calibration, molar mass sensitive detectors, the experimental difficulties, the instrumentation, and application examples are described.

The twenty seventh chapter deals with field flow fractionation techniques. In this part of the book are given, by the author, the principles and theory of retention, the experimental procedures, and applications of the technique.

The twenty eighth chapter discusses the instrumentation of countercurrent chromatography. Hydrostatic equilibrium countercurrent chromatography systems, the special techniques, two-phase solvent systems, and the future instrumentation of countercurrent chromatography are presented.

The twenty ninth chapter presents hyphenation of high performance liquid chromatography with different techniques. The technique of high performance liquid chromatography can be successfully hyphenated with mass spectroscopy, Fourier transform-infrared spectroscopy, nuclear magnetic resonance spectroscopy, inductively coupled plasma spectroscopy, and gas chromatography; also, we can see, in this chapter, multiple hyphenation or hypernation of liquid chromatography with spectroscopy.

The thirtieth chapter presents thin layer chromatography. In this chapter are discussed sample preparation, stationary and mobile phases, application of samples, chromatogram development, zone detection and identification, documentation of chromatograms, quantitative analysis, hyphenation of the technique with mass, infrared, and Raman spectrometry. Also, in this chapter, preparative layer chromatography, thin layer radiochromatography, and applications of thin layer chromatography are presented.

The final, thirty first, chapter deals with validation of chromatographic methods. Pre-validation requirements, method validation requirements, and method validation examples are given.

I have personally found this volume helpful on numerous occasions. The fact that this is the third edition gives clear evidence about how useful it is among the following groups: those who are either starting out for the first time in chemical analysis, those who are well practiced in the techniques of analytical instrumentation, or those who would simply like to read more about the subject.

The only shortcoming I have found is that chapters twenty two and twenty nine should be combined into a single chapter.

This book is highly recommended for advanced undergraduate students of analytical chemistry. It is a must for researchers in the field of analytical

chemistry. The book is more helpful in method choice and method development rather than troubleshooting.

Every chapter incorporates an extensive bibliography that gives easy access to the original literature.

Although it is a multi-authored volume, it has been well compiled, so that there is no overlap of topics or ideas, and the style is very consistent.

To sum up, the book can be highly recommended as a valuable new source of information to students and scientists working within the field of analytical chemistry and related areas.

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