

FTIR SPECTROSCOPY REFERENCE GUIDE

The Molecular Laboratory
2017

INTRODUCTION

FTIR Spectroscopy is a powerful analytical tool for identifying and quantifying chemical compounds. It measures the absorption of infrared light by a sample, which is then converted into a spectrum. The spectrum shows the characteristic absorption bands of the sample, which can be used to identify the compound and determine its concentration.

FTIR SPECTROSCOPY PRINCIPLES

FTIR Spectroscopy is based on the principle of interference. A beam of light is split into two paths, one of which is reflected back and forth many times before being recombined with the other path. This creates an interference pattern that is measured and converted into a spectrum.

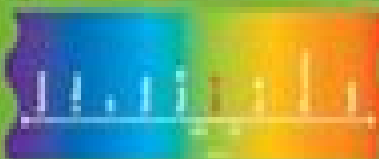
The spectrum shows the characteristic absorption bands of the sample, which can be used to identify the compound and determine its concentration.

$$I = I_0 e^{-\epsilon c l}$$

Where I is the intensity of the light, I_0 is the initial intensity, ϵ is the molar absorptivity, c is the concentration, and l is the path length.

The spectrum shows the characteristic absorption bands of the sample, which can be used to identify the compound and determine its concentration.

Wavenumber (cm⁻¹)



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FTIR SPECTROSCOPY APPLICATIONS

FTIR Spectroscopy is used in a wide range of applications, including:

- Identifying unknown compounds
- Determining the concentration of a compound in a mixture
- Studying chemical reactions
- Analyzing the structure of polymers

FTIR SPECTROSCOPY INSTRUMENTATION

The FTIR Spectrometer consists of the following components:

- Source
- Beam splitter
- Sample
- Detector

The source emits a beam of light that is split into two paths by the beam splitter. One path passes through the sample, and the other path is reflected back and forth many times before being recombined with the other path.

The detector measures the intensity of the light, which is then converted into a spectrum. The spectrum shows the characteristic absorption bands of the sample, which can be used to identify the compound and determine its concentration.

FTIR SPECTROSCOPY INSTRUMENTATION

Source

Beam splitter

Sample

Detector

FTIR Spectrometer

FTIR SPECTROSCOPY INSTRUMENTATION

Wavenumber (cm ⁻¹)	Sample	Wavenumber (cm ⁻¹)
4000	Water	3600
3600	Alcohol	3300
3300	Carboxylic acid	3000
3000	Alkane	2900
2900	Alkene	2800
2800	Alkyne	2600
2600	Aldehyde	2400
2400	Alkyne	2200
2200	Alkyne	2100
2100	Alkyne	2000
2000	Alkyne	1900
1900	Alkyne	1800
1800	Alkyne	1700
1700	Alkyne	1600
1600	Alkyne	1500
1500	Alkyne	1400
1400	Alkyne	1300
1300	Alkyne	1200
1200	Alkyne	1100
1100	Alkyne	1000
1000	Alkyne	900
900	Alkyne	800
800	Alkyne	700
700	Alkyne	600
600	Alkyne	500
500	Alkyne	400

Wavenumber (cm ⁻¹)	Sample	Wavenumber (cm ⁻¹)
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2200	Alkyne	2100
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1300	Alkyne	1200
1200	Alkyne	1100
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800	Alkyne	700
700	Alkyne	600
600	Alkyne	500
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Shannon Croft



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Conservation of Architectural and Urban Heritage Tarek Teba, Antonino Di Raimo, 2025-08-05 This book peers into the concept of conservation under the framework of sustainability The world s architectural history is in danger due to a lack of understanding expertise and care Some monuments have already been lost and more are under threat Heritage needs to be well understood interpreted defined and managed for future generations as it provides communities and cultures with retrospection and contributes to recorded history Additionally it discusses the relationship between cultural heritage preservation and sustainable development as well as restoration efforts for tangible and intangible cultural heritage assets The book aims to assist professionals working in the field of heritage conservation whether it is cultural rural architectural tangible or intangible It stands to be a valuable resource for architects and engineers as well as for conservators archaeologists environmentalists and policy makers

Spectrophotometry , 2014-06-28 This volume is an essential handbook for anyone interested in performing the most accurate spectrophotometric or other optical property of materials measurements The chapter authors were chosen from the leading experts in their respective fields and provide their wisdom and experience in measurements of reflectance transmittance absorptance emittance diffuse scattering color and fluorescence The book provides the reader with the theoretical underpinning to the methods the practical issues encountered in real measurements and numerous examples of important applications Written by the leading international experts from industry government and academia Written as a handbook with in depth discussion of the topics Focus on making the most accurate and reproducible measurements Many practical applications and examples

Nielsen's Food Analysis B. Pam Ismail, S. Suzanne Nielsen, 2024-06-24 This sixth edition provides information on techniques needed to analyze foods for chemical and physical properties The book is ideal for undergraduate courses in food analysis and it is also an invaluable reference for professionals in the food industry General information chapters on regulations labeling sampling and data handling provide background information for chapters on specific methods to determine chemical composition and characteristics physical properties and constituents of concern Methods of analysis cover information on the basic principles advantages limitations and applications The information on food analysis applications has been expanded in a number of chapters that cover basic analytical techniques Instructors who adopt the textbook can contact B Ismail for access to a website with related teaching materials

Practical Quantitative Vibrational and Electronic Spectroscopy Deborah A. Peru, 2025-12-11 An expert collection of case studies real world examples and up to date info about quantitative spectroscopic methods In Practical Quantitative Vibrational and Electronic Spectroscopy A Guide For Developing Optimizing and Validating Procedures experienced spectroscopist Deborah Peru and an expert team of contributors deliver an up to date discussion of the development of the quantitative spectroscopic methods used for measuring samples in the ultraviolet visible near IR and mid IR regions of the spectrum The book presents and reviews statistical considerations method development

and standard quantitative techniques involving regression and other approaches This coverage explores many of the techniques used in industry and academia for extracting quantitative information from spectra You ll discover how to develop and implement spectroscopic methods for analysis in products using commercial instruments and software Readers will also find A thorough introduction to real world issues in spectroscopy including expeditious development timelines and procedure lifecycle management Comprehensive explorations of the fundamentals of quantitative spectroscopy Practical discussions of quantitative applications and statistical analysis of spectral data Select examples of the real world implementation of spectroscopic technologies Perfect for scientists process engineers and managers supervising the development and use of spectroscopic instruments Practical Quantitative Vibrational and Electronic Spectroscopy will also benefit students interested in this rapidly developing collection of technologies

Global Impacts of Micro- and Nano-Plastic Pollution

Gaur, Nisha, Sharma, Eti, Nguyen, Tuan Anh, Bilal, Muhammad, Melkania, Niranjana Prakash, 2024-09-25 The presence of micro and nano plastic pollution has emerged as a critical threat to environmental sustainability As plastic materials degrade into smaller particles less than 5 millimeters in size they infiltrate terrestrial ecosystems posing a danger to both the environment and human health Despite the ongoing efforts of scientists worldwide the scientific community still faces significant challenges in fully grasping the complexity and degradation of these microplastics and nanoplastics let alone finding effective solutions to curb their further spread As the urgency to address this issue grows there is a pressing need for a comprehensive resource that delves into the intricacies of micro and nano plastic pollution and offers actionable insights for mitigation Global Impacts of Micro and Nano Plastic Pollution meticulously tackles the multifaceted challenges posed by plastic pollution in our global ecosystems Authored by esteemed experts in the field this book offers a holistic analysis of micro plastics and nano plastics providing readers with invaluable insights into their characterization sources and fate in the environment Through comprehensive case studies and cutting edge research readers will gain a deeper understanding of the adverse effects of broken down plastics pollution on soil health plant biology and overall ecological balance

High Performance Liquid Chromatography in Pesticide Residue Analysis Tomasz Tuzimski, Joseph Sherma, 2015-05-20 HPLC

is the principal separation technique for identification of the pesticides in environmental samples and for quantitative analysis of analytes At each stage of the HPLC procedure the chromatographer should possess both the practical and theoretical skills required to perform HPLC experiments correctly and to obtain reliable repeatable and r Molecular and Laser Spectroscopy V.P. Gupta, 2022-08-21 Molecular and Laser Spectroscopy Advances and Applications Volume 3 gives students and researchers an up to date understanding of the fast developing area of molecular and laser spectroscopy This book covers basic principles and advances in several conventional as well as new and upcoming areas of molecular and laser spectroscopy This third volume is an extension of the two previous volumes of the same title and includes all new topics Each chapter is devoted to a particular fast growing area of research and fills the gap between elementary texts and advanced

material found in research articles Some of the topics covered include terahertz spectroscopy and its applications in health care linear and non linear vibrational optical activity spectroscopy cascade laser IR spectroscopy and frequency comb techniques step scan infrared spectroscopy absorption and emission for detecting reaction intermediates surface enhanced SERS and tip enhanced TERS Raman scattering infrared and Raman micro spectroscopy time resolved linear and non linear infrared spectroscopy using pico second and femtosecond lasers The spectroscopic techniques have been applied to medical sciences forensics security material science agriculture food chemical pharmaceutical and petrochemical industries and used to study molecular vibrational dynamics and hydrogen bonding in ground and excited states This book serves as a valuable resource for students teachers and beginning researchers engaged in the area of molecular and laser spectroscopy On account of the wide range of applications researchers and scientific personnel in many industries will find this book useful for learning about the latest techniques and putting them to practical use Written by eminent research scientists having an intricate knowledge of the latest activities in the field Includes exhaustive lists of research articles reviews and books at the end of each chapter to aid in further pursuit of research activity Uses illustrative examples of the varied applications to provide a practical guide to those interested in using molecular and laser spectroscopy tools in their research Each chapter is written in simple clear language and develops its topic systematically from basics to the latest developments and future projections

Principles and Practice of Modern Chromatographic Methods Kevin Robards, Danielle Ryan, 2021-12-03
Principles and Practice of Modern Chromatographic Methods Second Edition takes a comprehensive unified approach in its presentation of chromatographic techniques Like the first edition the book provides a scientifically rigid but easy to follow presentation of chromatography concepts that begins with the purpose and intent of chromatographic theory the what and why that are left out of other books attempting to cover these principles This fully revised second edition brings the content up to date covering recent developments in several new sections and an additional chapter on composite methods New topics include sample profiling sample preparation sustainable green chemistry 2D chromatography miniaturization nano LC HILIC and more Contains thorough chapters that begin with an updated schematic overview and a visual representation of the content Avoids the obfuscation of different terminologies and classification systems that are prevalent in the area such as the relationship between liquid chromatography and column chromatography Provides integrated and comprehensive topic coverage based on chromatographic bibliometrics and survey reports on the relative usage of chromatographic techniques

Characterization of Solid Materials and Heterogeneous Catalysts, 2 Volume Set Michel Che, Jacques C. Vedrine, 2012-05-14 This two volume book provides an overview of physical techniques used to characterize the structure of solid materials on the one hand and to investigate the reactivity of their surface on the other Therefore this book is a must have for anyone working in fields related to surface reactivity Among the latter and because of its most important industrial impact catalysis has been used as the directing thread of the book After the preface and a general introduction to physical

techniques by M Che and J C Vedrine two overviews on physical techniques are presented by G Ertl and Sir J M Thomas for investigating model catalysts and porous catalysts respectively The book is organized into four parts Molecular Local Spectroscopies Macroscopic Techniques Characterization of the Fluid Phase Gas and or Liquid and Advanced Characterization Each chapter focuses upon the following important themes overview of the technique most important parameters to interpret the experimental data practical details applications of the technique particularly during chemical processes with its advantages and disadvantages conclusions

Overcoming the Challenges of Herbal Adulteration in a Globalized World Anthony Booker, Aljawharah Alqathama, Stefan Gafner, Sukvinder Kaur Bhamra, 2022-01-12

Solar Selective Absorbers Belal Usmani, Ambesh Dixit, Vivek Vijay, Rahul Chhibber, 2024-11-29 Solar Selective Absorbers Materials Coatings and Applications covers different harnessing technologies for solar energy electromagnetic radiation including design principles and different types of spectrally selective coatings The book emphasizes experimental methods for synthesizing these coating structures and characterization techniques to quantify the absorber characteristics suitable for solar thermal applications It also provides a compact review of the literature on solar spectrally selective absorber materials and coatings Summarizes the materials deposition and characterization techniques and applications of solar selective absorbers Introduces solar selective absorber materials and photothermal technology Explores electrodeposition techniques and their use in the development of solar selective absorber films Provides understanding of solar selective absorber materials and coating techniques in photothermal technology Explains sputtering techniques and their use in the development of ZrO₂ ZrC ZrN Zr tandem structure based solar selective absorber films The book is aimed at researchers and graduate students in solar energy solar thermal conversion and materials science

Write Like a Chemist Marin Robinson, 2008-08-18 Concise writing and organizational skills are stressed throughout and move structures teach students conventional ways to present their stories of scientific discovery

Undergraduate Instrumental Analysis Thomas J. Bruno, James W. Robinson, George M. Frame II, Eileen M. Skelly Frame, 2023-07-31 Analytical instrumentation is crucial to research in molecular biology medicine geology food science materials science forensics and many other fields Undergraduate Instrumental Analysis 8th Edition provides the reader with an understanding of all major instrumental analyses and is unique in that it starts with the fundamental principles and then develops the level of sophistication that is needed to make each method a workable tool for the student Each chapter includes a discussion of the fundamental principles underlying each technique detailed descriptions of the instrumentation and a large number of applications Each chapter includes an updated bibliography and problems and most chapters have suggested experiments appropriate to the technique This edition has been completely updated revised and expanded The order of presentation has been changed from the 7th edition in that after the introduction to spectroscopy UV Vis is discussed This order is more in keeping with the preference of most instructors Naturally once the fundamentals are introduced instructors are free to change the order of

presentation Mathematics beyond algebra is kept to a minimum but for the interested student in this edition we provide an expanded discussion of measurement uncertainty that uses elementary calculus although a formula approach can be used with no loss of context Unique among all instrumental analysis texts we explicitly discuss safety up front in Chapter 2 The presentation intentionally avoids a finger wagging thou shalt not approach in favor of a how to discussion of good laboratory and industrial practice It is focused on hazards and remedies that might be encountered in the use of instrumentation Among the new topics introduced in this edition are Photoacoustic spectroscopy Cryogenic NMR probes and actively shielded magnets The nature of mixtures in the context of separations Troubleshooting and leaks in high vacuum systems such as mass spectrometers Instrumentation laboratory safety Standard reference materials and standard reference data In addition the authors have included many instrument manufacturer s websites which contain extensive resources We have also included many government websites and a discussion of resources available from National Measurement Laboratories in all industrialized countries Students are introduced to standard methods and protocols developed by regulatory agencies and consensus standards organizations in this context as well

Analysis of Microplastics and Nanoplastics Huahong Shi,Chengjun Sun,2024-10-04 Analysis of Microplastics and Nanoplastics comprehensively overviews the common analytical methods for microplastic and nanoplastic analysis With a strong focus on sustainability the book covers the analysis process from sampling separation enrichment observation to identification of polymer composition and a presentation of data This book presents the unique features of microplastics and nanoplastics as particle contaminants their heterogenous distribution in the environments and biota and the complexity and difficulty of their analysis compared with typical solvent contaminants Analysis of Microplastics and Nonoplastics will provide researchers with a solid background to the environmental issues analytical challenges and current state of the different available methods for micro and nanoplastics to start or develop research Comprehensively discusses the common analytical methods of microplastics and nanoplastics providing basic fundamental knowledge of this hot topic Presents the new advances in this growing field Provides a tool book for readers

Advancements in Algal Biofuels Research - Recent Evaluation of Algal Biomass Production and Conversion Methods of into Fuels and High Value Co-products Umakanta Jena,S. Kent Hoekman,2017-05-18 Algae biomass has enormous potential to produce fuels and value added products Algae derived biofuels and bioproducts offer great promise in contributing to U S energy security and in mitigating the environmental concerns associated with conventional fuels Algae s ability to grow in low quality water wastewater and to accumulate lipids has encouraged scientists to investigate algae as a medium for wastewater treatment and a potential source of fuel and bioproducts There are growing demands for biomass based transportation fuels including biodiesel bio oil biomethane biohydrogen and other high value products nutraceuticals proteins omega 3 etc Algae can help address these needs The topic of algae energy includes the production and characterization of algae cultures conversion into fuel feedstocks and high value products and optimization of product

isolation and use In view of the increasing efforts in algae biomass production and conversion into energy and high value products the current research topic covers important aspects of algal strain selection culture systems inorganic carbon utilization lipid metabolism and quality biomass harvesting extraction of lipids and proteins and thermochemical conversion of algal feedstocks into biocrude **American Laboratory** ,2007 Additives in Polymers Jan C. J. Bart,2005-04-08 This industrially relevant resource covers all established and emerging analytical methods for the deformation of polymeric materials with emphasis on the non polymeric components Each technique is evaluated on its technical and industrial merits Emphasis is on understanding principles and characteristics and industrial applicability Extensively illustrated throughout with over 200 figures 400 tables and 3 000 references Modern Paints Uncovered ,2007 Paint formulations and history Analysis and characterization Treatments Cleaning issues Behavior and properties Posters *Kermes* 133 AA.VV.,2025-02-14 Attualit La basilica papale di Santa Maria degli Angeli ad Assisi accessibile ai visitatori durante il restauro conservativo Il ritorno a Venezia del Soffitto Corner di Giorgio Vasari La Convenzione dell Aja del 1954 e la nascita dell Associazione dello Scudo Blu Italia Un breve excursus Plastica arte e design Innovazioni nella conservazione contemporanea Introduzione Paola Carnazza Alla scoperta di un materiale artistico non convenzionale i trasferibili a secco Letraset Thais Biazioli de Oliveira Sandra Vazquez Dominique Sclarone La plastica come opera d arte nella collezione museale Politipo 4 1972 di Alberto Biasi in tessuto PVC Paola Carnazza Gestione dei depositi e problematiche di conservazione delle collezioni museali di manufatti industriali in plastica Alice Hansen Pina Di Pasqua Elisa Storace Elena Maierotti Daniela Zambelli Marco Calvi Possiamo prevedere l invecchiamento della plastica nelle opere d arte Massimo Lazzari Tha s L pez Mor n Trasparente 1974 di Carla Accardi un approccio puntuale per il restauro del Sicofoil Paola Iazurlo Desir e Rossi Simona Scimia Giancarlo Sidoti Sassi 1967 di Piero Gilardi Nuovi materiali per il trattamento del poliuretano espanso flessibile di tipo etere Luisa Mensi PERSPECTIVE Un nuovo progetto scientifico finanziato dal MUR dedicato allo sviluppo di strategie analitiche per la conoscenza e la conservazione preventiva degli oggetti in plastica Francesca Rosi Irene Bargagli Laura Cartechini Claudio Costantino Francesca Sabatini Antonella Caterina Boccia Ilaria Degano Francesca Modugno Jacopo La Nasa Daniela Comelli Sabrina Samela Luca Andena Grazia de Cesare Alessandra Botteon Valeria di Tullio David Buti Lucrezia Barchi Costanza Miliani Jana Striova Valentina Righetti Lucia Comez Martina Alunni Cardinali Le rubriche di Kermes PILLOLE DI RESTAURO TIMIDO Mitezza Preferirei di no Colore Marco Ermentini Shy Architecture Association FOTOGRAFIE Il fascino delle stampe Photochrom Donatella Mat 2014 2024 YOCOCU SI RACCONTA Sostenibilit innovazione e diagnostica nella conservazione del PVC delle bambole Barbie Intervista a Francesca Irene Barbaccia e Livia Marinelli Paola Carnazza ACTGREENER Le maschere del Sepik al Mus e du Quai Branly JC la nascita di una collezione 1914 1999 Eleonora Casarotti INTERNET PER IL RESTAURO Da Ben Laposky fino all ArtBase Anthologies E proseguendo ancora pi in avanti Giancarlo Buzzanca LE FONTI Bellori Barocci e dintorni il fil rouge degli incarnati Claudio Seccaroni SUPSI La

manutenzione della facciata della cattedrale di San Lorenzo a Lugano Giacinta Jean Stefania Luppichini Francesca Piqu
Taccuino IGIIC Lorenzo Appolonia Journal de la Société Royale D'astronomie Du Canada Royal Astronomical Society of
Canada,2008 Library catalogue in 1911 31 p appended to v 4

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Ftir Spectroscopy Reference Guide Agilent Introduction

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