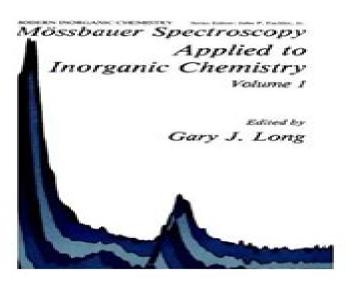
Mossbauer Spectroscopy Applied to Inorganic Chemistry, Vol.
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# **Mossbauer Spectroscopy Applied To Inorganic Chemistry**

Philipp Gütlich, Eckhard Bill, Alfred X. Trautwein

## **Mossbauer Spectroscopy Applied To Inorganic Chemistry:**

Mössbauer Spectroscopy Applied to Inorganic Chemistry G.J Long, 1984-12-31 When presented with a new compound or material the inorganic chemist will usually have several questions in mind about its composition and structure Although a simple elemental analysis may answer many questions about its composition the chemist will still have questions about its structure and if the material contains a metal atom he will often want to know its oxidation state coordination number and geometry Further at an increasingly frequent rate the chemist may need details of the spin state magnetic and perhaps dynamic properties of the material If the investigator is fortunate the material or compound may contain an element such as iron tin antimony iodine gold or one of several of the rare earth metals which are amenable to study by the Mossbauer effect Often the Mossbauer effect can sometimes with quite simple experiments provide the answers to all of these questions The goal of this book is to illustrate the effectiveness of the Mossbauer effect in providing the answers to the many questions that arise in char acterizing new materials and indeed in studying known materials in more detail Several chapters introduce the effect to the novice and provide details about the various hyperfine interactions that are the bread and butter of the Mossbauer spectroscopist Three chapters deal specifically with the experimental aspects of the technique and the increasing importance of sophisticated computer analysis of the resulting data Mössbauer Spectroscopy Applied to Inorganic Chemistry G.J Long, 2013-11-11 When presented with a new compound or material the inorganic chemist will usually have several questions in mind about its composition and structure Although a simple elemental analysis may answer many questions about its composition the chemist will still have questions about its structure and if the material contains a metal atom he will often want to know its oxidation state coordination number and geometry Further at an increasingly frequent rate the chemist may need details of the spin state magnetic and perhaps dynamic properties of the material If the investigator is fortunate the material or compound may contain an ele ment such as iron tin antimony iodine gold or one of several of the rare earth metals which are amenable to study by the Mossbauer effect Often the Mossbauer effect can sometimes with quite simple experiments provide the answers to all of these questions. The goal of this book is to illustrate the effectiveness of the Mossbauer effect in providing the answers to the many questions that arise in char acterizing new materials and indeed in studying known materials in more detail Several chapters introduce the effect to the novice and provide details about the various hyperfine interactions that are the bread and butter of the Mossbauer spectroscopist Three chapters deal specifically with the experimental aspects of the technique and the increasing importance of sophisticated computer analysis of the resulting data Mossbauer Spectroscopy Applied to Inorganic Chemistry Gary J. Long, 2001

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2 Ion implantation M ssbauer effect studies H de Waard and L Niesen M ssbauer effect studies of microcrystalline materials Steen M rup M ssbauer spectroscopy of mixed valence compounds Hellmut Eckert M ssbauer effect studies on low dimensional magnetic solids M F Thomas Chemical influences on the supertransferred hyperfine field Fernande Grandjean M ssbauer spectroscopy of reduced ferritin R B Frankel G C Papaefthymiou and G D Watt M ssbauer effect studies of metallic glasses Geoffrey Longworth Tellurium 125 M ssbauer spectroscopy in the characterization of tellurium compounds Frank I Berry M ssbauer spectroscopy with the iodine isotopes R V Parish M ssbauer spectroscopic studies of compounds of the 5d transition metals Alan F Williams M ssbauer effect studies of the actinides B D Dunlap Iron oxides and oxyhydroxides Enver Mössbauer Spectroscopy Applied to Magnetism and Materials Science G.J Long, F. Murad and James H Johnston Grandjean, 2013-06-29 This book represents Volume 2 in a series on the use of Mossbauer spectroscopy in the study of magnetism and materials However the perceptive reader will notice some differences from Volume 1 Specifically in order to market the book at a more affordable price for most universities and research laboratories the book has been prepared in camera ready format The editors and the authors agreed to do this because there is a demand for such a book in the Mossbauer community This format has placed an extra burden on the editors and the authors and we hope we have overcome all the difficulties generated by the transfer of files between different computers In order to make the book more attractive to materials scientists who are not experts in Mossbauer spectroscopy this volume is particularly oriented towards the study of materials by Mossbauer spectroscopy and related complementary techniques such as neutron scattering and a variety of surface scattering techniques The authors of this volume can be proud of the high quality professional effort they have devoted to clearly presenting their specific topics As a result we very much enjoyed working with the authors on this volume We hope that their effort will help to educate the next generation of Mossbauer effect spectroscopists a generation which will face the challenge of maintaining equally high scientific and professional standards in their research work Spectroscopy and Transition Metal Chemistry P. Gütlich, R. Link, A. Trautwein, 2013-11-11 Two decades have passed since the original discovery of recoilless nuclear gamma resonance by Rudolf Mossbauer the spectroscopic method based on this resonance effect referred to as Mossbauer spectroscopy has developed into a powerful tool in solid state research The users are chemists physicists biologists geologists and scientists from other disciplines and the spectrum of problems amenable to this method has become extraordinarily broad In the present volume we have confined ourselves to applications of Mossbauer spectroscopy to the area of transition elements We hope that the book will be useful not only to non Mossbauer special ists with problem Oriented activities in the chemistry and physics of transition elements but also to those actively working in the field of Mossbauer spectroscopy on systems compounds as well as alloys of transition elements The first five chapters are directed to introducing the reader who is not familiar with the technique to the principles of the recoilless nuclear resonance effect the hyperfme interactions between nuclei and electronic properties such as electric and magnetic

fields some essential aspects about measurements and the evaluation of Moss bauer spectra Chapter 6 deals with the interpretation of Mossbauer parameters of iron compounds Here we have placed emphasis on the information about the electronic structure in correlation with quantum chemical methods because of its importance for chemical bonding and magnetic properties **Applications of Analytical Techniques to the Characterization of Materials** D.L.

Perry,2013-06-29 Over the last several years the field of materials science has witnessed an explosion of new advanced materials They encompass many uses and include superconductors alloys glasses and catalysts Not only are there quite a number of new enhies into these generic classes of materials but the materials themselves represent a wide array of physical forms as well Bulk materials for example are being synthesized and applications found for them while still other materials are being synthesized as thin films for yet still more new and in some cases as yet unknown applications. The field continues to expand with thankfully no end in sight as to the number of new possibilities. As work progresses in this area there is an ever increasing demand for knowing not only what material is formed as an end product but also details of the route by which it is made. The knowledge of reaction mechanisms in their synthesis many times allows a researcher to tailor a preparative scheme to either arrive at the final product in a purer state or with a better yield Also a good fundamental experimental knowledge of impuri ties present in the final material helps the investigator get more insight into making it

Mössbauer Spectroscopy Applied to Magnetism and Materials Science G.J Long, F. Grandjean, 2013-06-29 During the past 30 years materials science has developed into a full fledged field for basic and applied scientific enquiry Indeed materials scientists have devoted their efforts to creating new materials with improved electronic magnetic thermal mechanical and optical properties Often unnoticed these new materials are rapidly invading our homes and automobiles and may be found in our utensils electronic equipment textiles home appliances and electric motors Even though they may go unnoticed these new materials have either improved the efficiency and lifetime of these items or have reduced their weight or cost In particular magnetically ordered materials are useful in various applications such as motors magnetic imaging magnetic recording and magnetic levitation Hence much effort has been devoted to the development of better hard magnetic materials magnetic thin films and molecular magnets During the same period of time Mossbauer effect spectroscopy has grown from a laboratory curiosity to a mature spectroscopic technique a technique that probes solid state materials at specific atomic sites and yields microscopic information on the magnetic and electronic properties of these materials Iron 57 is the most commonly and easily used Mossbauer effect isotope and of course is particularly relevant for the study of magnetic materials Various applications of Mossbauer spectroscopy to magnetic materials are discussed in the first six chapters of this volume Other isotopes such as zinc 67 and gadolinium ISS have recently been used to study the electronic properties of zinc compounds and the electronic and magnetic properties of rare earth transition metal compounds

Mossbauer Spectroscopy Applied to Magnetism and Materials Science Fernande Grandjean, Gary J. Long, 1993

Mössbauer Spectroscopy and Transition Metal Chemistry Philipp Gütlich, Eckhard Bill, Alfred X. Trautwein, 2010-12-25 concentrates on teaching techniques using as much theory as needed application of the techniques to many problems of materials characterization M ssbauer spectroscopy is a profound analytical method which has nevertheless continued to develop The authors now present a state of the art book which consists of two parts The first part details the fundamentals of M ssbauer spectroscopy and is based on a book published in 1978 in the Springer series Inorganic Chemistry Concepts by P G tlich R Link and A X Trautwein The second part covers useful practical aspects of measurements and the application of the techniques to many problems of materials characterization. The update includes the use of synchroton radiation and many instructive and illustrative examples in fields such as solid state chemistry biology and physics materials and the geosciences as well as industrial applications Special chapters on magnetic relaxation phenomena S Morup and computation of hyperfine interaction parameters F Neese are also included The book concentrates on teaching the technique using theory as much as needed and as little as possible The reader will learn the fundamentals of the technique and how to apply it to many problems of materials characterization Transition metal chemistry studied on the basis of the most widely used M ssbauer isotopes will be in the foreground Mössbauer Spectroscopy Yutaka Yoshida, Guido Langouche, 2012-11-08 Tutorials on M ssbauer Spectroscopy Since the discovery of the M ssbauer Effect many excellent books have been published for researchers and for doctoral and master level students However there appears to be no textbook available for final year bachelor students nor for people working in industry who have received only basic courses in classical mechanics electromagnetism quantum mechanics chemistry and materials science. The challenge of this book is to give an introduction to M ssbauer Spectroscopy for this level The ultimate goal of this book is to give this audience not only a scientific introduction to the technique but also to demonstrate in an attractive way the power of M ssbauer Spectroscopy in many fields of science in order to create interest among the readers in joining the community of M ssbauer spectroscopists This is particularly important at times where in many M ssbauer laboratories succession is at stake This book will be used as a textbook for the tutorial sessions organized at the occasion of the 2011 International Conference on the Application of M ssbauer Spectroscopy ICAME2011 in Tokyo Mössbauer Spectroscopy of Environmental Materials and Their Industrial Utilization Enver Murad, John Cashion, 2011-06-28 M ssbauer Spectroscopy of Environmental Materials and their Industrial Utilization provides a description of the properties of materials formed on the earth's surface their synthetic analogs where applicable and the products of their modifications in the course of natural processes such as weathering or in industrial processing as reflected in their M ssbauer spectra Particular emphasis is placed on the way in which these processes can be observed and elucidated through the use of M ssbauer spectroscopy. The first chapter covers the basic theory of the M ssbauer effect and Chapters 2 and 3 deal with the nuts and bolts of experimental M ssbauer spectroscopy The principles of these first three chapters illustrated with many case studies are applied to different areas of interest in

Chapters 4 through 12 The book is directed to a broad audience ranging from graduate students in environmental sciences or chemical engineering with little or no expertise in M ssbauer spectroscopy to researchers from other disciplines who are familiar with this technique but wish to learn more about possible applications to environmental materials and issues

Interstitial Intermetallic Alloys F. Grandjean, G.J. Long, K.H.J. Buschow, 2012-12-06 It is well known that the density of molecular hydrogen can be increased by compression and or cooling the ultimate limit in density being that of liquid hydrogen It is less well known that hydrogen densities of twice that of liquid hydrogen can be obtained by intercalating hydrogen gas into metals The explanation of this unusual paradox is that the absorption of molecular hydrogen which in TiFe and LaNis is reversible and occurs at ambient temperature and pressure involves the formation of hydrogen atoms at the surface of a metal The adsorbed hydrogen atom then donates its electron to the metal conduction band and migrates into the metal as the much smaller proton These protons are easily accommodated in interstitial sites in the metal lattice and the resulting metal hydrides can be thought of as compounds formed by the reaction of hydrogen with metals alloys and intermetallic compounds The practical applications of metal hydrides span a wide range of technologies a range which may be subdivided on the basis of the hydride property on which the application is based The capacity of the metal hydrides for hydrogen absorption is the basis for batteries as well as for hydrogen storage gettering and purification The temperature pressure characteristics of metal hydrides are the basis for hydrogen compressors sensors and actuators The latent heat of the hydride formation is the basis for heat storage heat pumps and refrigerators Handbook of Solid State Chemistry, 6 Volume Set Richard Dronskowski, Shinichi Kikkawa, Andreas Stein, 2017-10-23 This most comprehensive and unrivaled compendium in the field provides an up to date account of the chemistry of solids nanoparticles and hybrid materials Following a valuable introductory chapter reviewing important synthesis techniques the handbook presents a series of contributions by about 150 international leading experts the Who s Who of solid state science Clearly structured in six volumes it collates the knowledge available on solid state chemistry starting from the synthesis and modern methods of structure determination Understanding and measuring the physical properties of bulk solids and the theoretical basis of modern computational treatments of solids are given ample space as are such modern trends as nanoparticles surface properties and heterogeneous catalysis Emphasis is placed throughout not only on the design and structure of solids but also on practical applications of these novel materials in real chemical situations Modern Mössbauer Spectroscopy Yutaka Yoshida, Guido Langouche, 2021-01-19 This book presents an overview of the latest M ssbauer spectroscopy research It sheds light on various cutting edge research subjects i nuclear resonance scattering experiments implemented at synchrotron radiation facilities e g ESRF DESY and Spring 8 ii multidisciplinary materials research related to chemistry biology geoscience molecular magnetism of metal complexes batteries and magnetism iii novel imaging techniques based on probing diffusion in solids using M ssbauer spectroscopy The first three chapters introduce recent research on modern M ssbauer

spectroscopy including nuclear resonant scattering experiments and development of related techniques at synchrotron accelerator facilities Chapters 4 and 5 then demonstrate the applications of such pioneering techniques to chemistry biology and geoscience Chapters 6 and 7 describe the applications to new functional materials i e metal complexes and Li and Na ion batteries while the final two chapters are devoted to two important measuring techniques M ssbauer spectroscopy under external magnetic fields and microscopic M ssbauer techniques on diffusion in solids which are expected to play an essential role in the investigation and characterization of magnetic structures and microstructures in materials The cutting edge content provides readers with quick updates on the latest research topics in the field while the tutorial style descriptions allow readers unfamiliar with M ssbauer spectroscopy to learn and implement the techniques As such the book is especially useful for advanced undergraduate and early graduate students who have recently been assigned to a laboratory

Spectroscopic Methods in Mineralogy A. Beran ,E. Libowitzky,2004 Iron Chelation in Plants and Soil Microorganisms Larry Barton,2012-12-02 Iron Chelation in Plants and Soil Microorganisms provides an introduction to the basic biological processes of plants that require iron and those affected by iron deficiency The book aims to stimulate research in the area of iron metabolism in plants and plant associated microorganisms The book is organized into three parts Part I provides an overview of research methods used in the study of iron chelation relevant to plant biology Key topics covered include microbial siderophores phytosiderophores and plant and microbial ferritins Part II discusses the molecular approach to iron chelation which includes molecular biology enzymology and iron uptake activities Part III addresses various physiological and chemical characteristics of the iron stress response This book was written for scientists involved in plant physiology agronomy phytopathology plant control and soil microbiology It may also be of interest to those studying soil chemistry plant mineral relationships horticulture in vivo and in vitro iron measurements and microbial ecology In addition the book can serve as reference for specialty courses and laboratories conducting research on iron nutrition in plants as well as individuals engaged in iron related research

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