

# HANDBOOK ON THE PHYSICS AND CHEMISTRY OF RARE EARTHS

Volume 33

Karl A. Gschneidner, Jr.

# **Handbook On The Physics And Chemistry Of Rare Earths Volume 34**

**Henning Höppe** 

#### Handbook On The Physics And Chemistry Of Rare Earths Volume 34:

Handbook on the Physics and Chemistry of Rare Earths, 2006-12-07 This volume of the Handbook on the Physics and Chemistry of Rare Earth begins with a Dedication to late Professor LeRoy Eyring who had been a committed co editor of the first 32 volumes of this series This is followed by four chapters the first two pertaining to solid state physics and materials science while the last two chapters describe organic and inorganic reactions mediated by tetravalent cerium based oxidants and by divalent samarium based reductants Chapter 227 is devoted to the description of the crystal chemistry and physical properties of rare earth bismuthides a class of compounds showing large similarities with the rare earth antimonides previously reviewed in volume 33 of this series The fascinating optical and electric properties of rare earth hydride films displaying a switchable mirror effect as a function of hydrogen pressure i e from a shiny metallic state to a transparent insulating film with increasing pressure are described in Chapter 228 along with their fabrication methods Many chemical reactions take advantage of the tetravalent trivalent Ce IV Ce III redox couple and many of its potential applications are presented in Chapter 229 from analytical procedures to electrosynthesis and organic and industrial polymerization reactions The last review Chapter 230 focuses on the synthesis and use of divalent samarium based reductants in organic and inorganic reactions mainly on those containing iodide and pentamethylcyclopentadienyl ligands Authoritative Comprehensive Up to date Critical Reliable Handbook on the Physics and Chemistry of Rare Earths Karl A. Gschneidner, Jean-Claude G. Bunzli, Vitalij K. Pecharsky, 2005-03-09 This volume of the Handbook adds five new chapters to the science of rare earths Two of the chapters deal with intermetallic compounds An overview of ternary systems containing rare earths transition metals and indium Chapter 218 opens the volume It is followed by Chapter 219 sorting out relationships between superconductivity and magnetism. The next two chapters are dedicated to complex compounds of rare earths Chapter 220 describes structural studies using circularly polarized luminescence spectroscopy of lanthanide systems while Chapter 221 examines rare earth metal organic frameworks also known as coordination polymers. The final Chapter 222 deals with the catalytic activity of rare earths in site selective hydrolysis of DNA and RNA Ya Kalychak V Zaremba R P ttgen M Lukachuk and R D Hoffmann review the synthesis conditions isothermal sections of phase diagrams crystallography and basic physical properties of ternary intermetallic compounds consisting of the rare earth metals transition metals and indium P Thalmeier and G Zwicknagl revisit the last decade of research uncovering some of the mysteries of the superconducting state especially those related to heavy fermion superconductivity and the co existence of the superconducting and exotic magnetically ordered states J P Riehl and G Muller review how the molecular stereochemistry of lanthanide complexes both in pure forms and in mixtures can be probed using circularly polarized luminescence O Guillou and C Daiguebonne assess rare earth containing metal organic frameworks also known as coordination polymers which hold a potential as working bodies for opto electronic and magnetic devices microporous materials for a variety of uses such as

size and shape selective separations catalyst support and hydrogen storage materials Concluding the volume M Komiyama argues that future biotechnology may well rely on the use of rare earth ions as unique catalysts that can slice DNA and RNA in order to allow their reprogramming and thus lead to more effective bioengineered processes **Rare Earth Chemistry** Rainer Pöttgen, Thomas Jüstel, Cristian A. Strassert, 2020-10-26 This work introduces into the chemistry materials science and technology of Rare Earth Elements The chapters by experienced lecturers describe comprehensively the recent studies of their characteristics properties and applications in functional materials Due to the broad range of covered topics as hydrogen storage materials LEDs or permanent magnets this work gives an up to date presentation of this fascinating research

Rare-Earths and Actinides in High Energy Spectroscopy Christiane Bonnelle, Nissan Spector, 2015-12-22 This unique monograph covers recent theoretical and experimental results on the complex character of f electrons in materials containing lanthanides rare earths or actinides such as alpha cerium and delta plutonium It answers the urgent need for a general presentation of the body of experimental and theoretical results presently available in this challenging domain Some of the fast developing applications of lanthanide and actinide materials are mentioned Materials containing atoms with an open f shell have electronic and crystalline properties that are controlled by the localized or delocalized character of the f electrons This book gives a theoretical discussion of the various spectroscopic methods that shed light on the character of the f electrons and on the connection between their localization and the properties of these materials Part 1 covers the characteristics of the f electrons in atoms and solids and includes a discussion of the properties of lanthanides and actinides in connection with the f electrons Part 2 describes the various spectroscopic methods that are used to establish the electronic distributions and energies of the states Examples involve the determination of f electron distributions by high energy spectroscopy methods with separate treatment of the valence and core electrons Part 3 concentrates on the theoretical treatment of electronic transitions involving f electrons and simulations of the lanthanide spectra including comparison with the available experimental data Part 4 discusses the localized or delocalized character of the f electrons in actinides and their compounds including comparison analogies differences between the 4f and 5f electron materials This monograph should be of great value for researchers academics and engineers working in the fields of high energy spectroscopy electronic and nuclear science and technology as well as materials involving rare earths and radio elements Rare Metal Technology 2014 Neale R. Neelameggham, Shafiq Alam, Harald Oosterhof, Animesh Jha, Shijie Wang, 2014-02-03 This collection presents the papers presented in the symposium on extraction of rare metals as well as rare extraction processing techniques used in metal production Paper topics include the extraction and processing of elements like antimony arsenic calcium chromium hafnium gold indium lithium molybdenum niobium rare earth metals rhenium scandium selenium silver strontium tantalum tellurium tin tungsten vanadium and zirconium Rare processing techniques presented include bio leaching molecular recognition technology recovery of valuable components of commodity metals such as magnesium from laterite process

wastes titanium from ilmenites and rare metals from wastes such as phosphors and LCD monitors Springer Handbook of Inorganic Photochemistry Detlef Bahnemann, Antonio Otavio T. Patrocinio, 2022-06-25 The handbook comprehensively covers the field of inorganic photochemistry from the fundamentals to the main applications. The first section of the book describes the historical development of inorganic photochemistry along with the fundamentals related to this multidisciplinary scientific field The main experimental techniques employed in state of art studies are described in detail in the second section followed by a third section including theoretical investigations in the field In the next three sections the photophysical and photochemical properties of coordination compounds supramolecular systems and inorganic semiconductors are summarized by experts on these materials Finally the application of photoactive inorganic compounds in key sectors of our society is highlighted. The sections cover applications in bioimaging and sensing drug delivery and cancer therapy solar energy conversion to electricity and fuels organic synthesis environmental remediation and optoelectronics among others The chapters provide a concise overview of the main achievements in the recent years and highlight the challenges for future research This handbook offers a unique compilation for practitioners of inorganic photochemistry in both industry and Molecular Technology, Volume 1 Hisashi Yamamoto, Takashi Kato, 2018-10-22 Edited by foremost leaders in academia chemical research together with a number of distinguished international authors this first of four volumes summarizes the most important and promising recent chemical developments in energy science all in one book Interdisciplinary and application oriented this ready reference focuses on chemical methods that deliver practical solutions for energy problems covering new developments in advanced materials for energy conversion semiconductors and much more besides Of great interest to chemists as well as researchers in the fields of energy science in academia and industry Superconducting Materials Anant V. Narlikar, 2005-12-06 Frontiers in Superconducting Materials gives a state of the art report of the most important topics of the current research in superconductive materials and related phenomena It comprises 30 chapters written by renowned international experts in the field It is of central interest to researchers and specialists in Physics and Materials Science both in academic and industrial research as well as advanced students It also addresses electronic and electrical engineers Even non specialists interested in superconductivity might find some useful answers

Rare Earths Paul Caro,1998 Rare-Earth Borides Dmytro S. Inosov,2021-10-24 Rare earth borides have attracted continuous interest for more than half a century both from the point of view of fundamental condensed matter physics and for practical applications in various fields of engineering They demonstrate a wealth of unusual electronic and magnetic properties that have been closely investigated in recent decades using advanced spectroscopies and state of the art physical characterization methods Authored by leading experts in the field this book features a comprehensive collection of reviews offering a cutting edge summary of the research on rare earth borides from various viewpoints It includes chapters on the growth and characterization of single crystal and thin film samples detailed description of their lattice structure and

dynamics electronic and magnetic properties in the bulk and at the surface low temperature ordering phenomena and theoretical and experimental description of the unusual spectroscopic properties from the perspective of modern x ray and neutron scattering Raman spectroscopy and electron spin resonance The book will appeal to anyone interested in the physics and chemistry of solids and low temperature physics especially to researchers and postgraduate students who study magnetic and electronic properties of rare earth compounds \*\*Antiferromagnetism\* and Superconductivity in Ce-based Heavy-Fermion Systems\* Edit Lengyel,2008 \*\*Lanthanides\* and Actinides\* in Molecular Magnetism\* Richard A. Layfield,Muralee Murugesu,2015-04-27 The first reference on this rapidly growing topic provides an essential up to date guide to current and emerging trends A group of international experts has been carefully selected by the editors to cover all the central aspects with a focus on molecular species while also including industrial applications The resulting unique overview is a must have for researchers both in academia and industry who are entering or already working in the field

Rare-Earth Elements Henning Höppe, 2024-03-18 When the author began working on phosphors based on rare earth elements he lacked an introductory textbook that explained the fundamental chemistry basic optical properties and magnetic characteristics of lanthanide elements This book provides a concise overview of the rare earth elements and is divided into two parts In the first part the reader receives an overview of solid state chemistry and fundamental physical properties of these elements Key topics of the first part include the separation chemistry of lanthanides their chemical behaviour and physical properties Then relevant compound classes are illustrated crystal structures are systematically explained The second part focuses on the optical and magnetic properties on relevant examples also discussing many applications Students and researchers new to the topic of Rare Earth Elements receive a comprehensive introduction to understand basic optical and magnetic properties and incentives for deeper studies **Photoelectron Spectroscopy** Shigemasa Suga, Akira Sekiyama, Christian Tusche, 2021-06-30 This book presents photoelectron spectroscopy as a valuable method for studying the electronic structures of various solid materials in the bulk state on surfaces and at buried interfaces This second edition introduces the advanced technique of high resolution and high efficiency spin and momentum resolved photoelectron spectroscopy using a novel momentum microscope enabling high precision measurements down to a length scale of some tens of nanometers The book also deals with fundamental concepts and approaches to applying this and other complementary techniques such as inverse photoemission photoelectron diffraction scanning tunneling spectroscopy as well as photon spectroscopy based on soft x ray absorption and resonance inelastic soft x ray scattering This book is the ideal tool to expand readers understanding of this marvelously versatile experimental method as well as the electronic structures of metals and insulators Mechanical Alloying And Milling Cury Suryanarayana, 2004-09-28 This book surveys the broad field of mechanical alloying from a scientific and technological perspective to form a timely and comprehensive resource valuable to both students and researchers The treatment progresses from the historical background through a description of the

process the different metastable effects produced and the mechanisms of Molecular Magnetic Materials Barbara Sieklucka, Dawid Pinkowicz, 2017-01-17 A comprehensive overview of this rapidly expanding interdisciplinary field of research After a short introduction to the basics of magnetism and molecular magnetism the text goes on to cover specific properties of molecular magnetic materials as well as their current and future applications Design strategies for acquiring molecular magnetic materials with desired physical properties are discussed as are such multifunctional materials as high Tc magnets chiral and luminescent magnets magnetic sponges as well as photo and piezo switching magnets The result is an excellent resource for materials scientists chemists physicists and crystal engineers either entering or already working in the field

The Chemistry of the Actinide and Transactinide Elements (Set Vol.1-6) L.R. Morss, Norman M. Edelstein, Jean Fuger, 2010-10-21 The fourth edition of The Chemistry of the Actinide and Transactinide Elements comprises all chapters in volumes 1 through 5 of the third edition published in 2006 plus a new volume 6 To remain consistent with the plan of the first edition to provide a comprehensive and uniform treatment of the chemistry of the actinide and transactinide elements for both the nuclear technologist and the inorganic and physical chemist and to be consistent with the maturity of the field the fourth edition is organized in three parts The first group of chapters follows the format of the first and second editions with chapters on individual elements or groups of elements that describe and interpret their chemical properties A chapter on the chemical properties of the transactinide elements follows The second group chapters 15 26 summarizes and correlates physical and chemical properties that are in general unique to the actinide elements because most of these elements contain partially filled shells of 5f electrons whether present as isolated atoms or ions as metals as compounds or as ions in solution The third group chapters 27 39 focuses on specialized topics that encompass contemporary fields related to actinides in the environment in the human body and in storage or wastes Two appendices at the end of volume 5 tabulate important nuclear properties of all actinide and transactinide isotopes Volume 6 Chapters 32 through 39 consists of new chapters that focus on actinide species in the environment actinide waste forms nuclear fuels analytical chemistry of plutonium actinide chalcogenide and hydrothermal synthesis of actinide compounds The subject and author indices and list of contributors The Chemistry of the Actinide and Transactinide Elements (3rd ed., Volumes 1-5) L.R. encompass all six volumes Morss, Norman M. Edelstein, Jean Fuger, 2007-12-31 The Chemistry of the Actinide and Transactinide Elements is a contemporary and definitive compilation of chemical properties of all of the actinide elements especially of the technologically important elements uranium and plutonium as well as the transactinide elements In addition to the comprehensive treatment of the chemical properties of each element ion and compound from atomic number 89 actinium through to 109 meitnerium this multi volume work has specialized and definitive chapters on electronic theory optical and laser fluorescence spectroscopy X ray absorption spectroscopy organoactinide chemistry thermodynamics magnetic properties the metals coordination chemistry separations and trace analysis Several chapters deal with environmental

science safe handling and biological interactions of the actinide elements The Editors invited teams of authors who are active practitioners and recognized experts in their specialty to write each chapter and have endeavoured to provide a balanced and insightful treatment of these fascinating elements at the frontier of the periodic table Because the field has expanded with new spectroscopic techniques and environmental focus the work encompasses five volumes each of which groups chapters on related topics All chapters represent the current state of research in the chemistry of these elements and related fields

Transition Metal and Rare Earth Compounds III Hartmut Yersin, 2004-11-18 With contribution by numerous experts Lectures on the Physics of Highly Correlated Electron Systems IX Adolfo Avella, Ferdinando Mancini, 2005-09-27 This book contains lectures on strongly correlated electron systems presented by eminent physicists These lectures are up to date summaries of relevant subjects in the field of condensed matter physics Contributions include BCS theory of nodal superconductors strongly correlated particle systems and composite operator methods diagonalization and numerical renormalization group based methods for interacting quantum systems as well as phenomenological aspects of unconventional superconductivity

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