

Nanomedicine and Nanotoxicology

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Lanthanide-Doped Luminescent Nanomaterials

From Fundamentals to Bioapplications

 Springer

Lanthanide Doped Luminescent Nanomaterials From Fundamentals To Bioapplications Nanomedicine And Nanotoxicology

Mingzhen Yao



Lanthanide Doped Luminescent Nanomaterials From Fundamentals To Bioapplications Nanomedicine And Nanotoxicology:

Lanthanide-Doped Luminescent Nanomaterials Xueyuan Chen,Yongsheng Liu,Datao Tu,2013-11-04 Lanthanide Doped Luminescent Nanomaterials reviews the latest advances in the development of lanthanide doped luminescent inorganic nanoparticles for potential bioapplications This book covers the chemical and physical fundamentals of these nanoparticles such as the controlled synthesis methodology surface modification chemistry optical physics and their promising applications in diverse bioassays with an emphasis on heterogeneous and homogeneous in vitro biodetection of tumor biomarkers This book is intended for those readers who are interested in systematically understanding the materials design strategy optical behavior of lanthanide ions and practical bioapplications of lanthanide nanoparticles It primarily focuses on the interdisciplinary frontiers in chemistry physics and biological aspects of luminescent nanomaterials All chapters were written by scientists active in this field and for a broad audience providing both beginners and advanced researchers with comprehensive information on the subject Xueyuan Chen is a Professor at Fujian Institute of Research on the Structure of Matter FJIRSM Chinese Academy of Sciences Yongsheng Liu is a Research Associate Professor at FJIRSM Chinese Academy of Sciences Datao Tu is a Research Assistant Professor at FJIRSM Chinese Academy of Sciences

Ceramic Materials for Energy Applications V Josef Matyas,Yutai Katoh,Hua-Tay Lin,Alberto Vomiero,2016-01-05 The Ceramic Engineering and Science Proceeding has been published by The American Ceramic Society since 1980 This series contains a collection of papers dealing with issues in both traditional ceramics i e glass whitewares refractories and porcelain enamel and advanced ceramics Topics covered in the area of advanced ceramic include bioceramics nanomaterials composites solid oxide fuel cells mechanical properties and structural design advanced ceramic coatings ceramic armor porous ceramics and more

Controlling Size and Surface Property of Lanthanide-doped Luminescent Nanoparticles for Bio-applications 2018 Women in Lanthanide-based Luminescence Research: From Basic

Research to Applications Qianqian Su,Lining Sun,Eva Hemmer,Ho Seong Jang,2021-05-18 **Luminescence of Lanthanide Ions in Coordination Compounds and Nanomaterials** Ana de Bettencourt-Dias,2014-11-17 This comprehensive book presents the theoretical principles current applications and latest research developments in the field of luminescent lanthanide complexes a rapidly developing area of research which is attracting increasing interest amongst the scientific community Luminescence of Lanthanide Ions in Coordination Compounds and Nanomaterials begins with an introduction to the basic theoretical and practical aspects of lanthanide ion luminescence and the spectroscopic techniques used to evaluate the efficiency of luminescence Subsequent chapters introduce a variety of different applications including Circularly polarized luminescence Luminescence bioimaging with lanthanide complexes Two photon absorption of lanthanide complexes Chemosensors Upconversion luminescence Excitation spectroscopy Heterometallic complexes containing

lanthanides Each chapter presents a detailed introduction to the application followed by a description of experimental techniques specific to the area and an extensive review of recent literature This book is a valuable introduction to the literature for scientists new to the field as well as providing the more experienced researcher with a comprehensive resource covering the most relevant information in the field a one stop shop for all key references *Photofunctional Nanomaterials for Biomedical Applications* Chunxia Li,Jun Lin,2025-03-31 Summary of the controlled synthesis of photofunctional nanoparticles and their hybrid nanocomposites as well as their potential in biomedical applications Photofunctional Nanomaterials for Biomedical Applications presents the latest research and developments surrounding photofunctional nanomaterials including rare earth luminescence nanomaterials and photothermal agents for biomedical applications related to imaging biosensing controlled drug delivery and release and tumor diagnosis and therapy as well as other applications such as bacteria engineering optical information storage acoustic sensing and temperature detection The book elucidates the underlying functioning mechanisms of these nanomaterials in depth and extensively discusses their current challenges and future development prospects Written by two highly qualified professors with significant research experience in the field Photofunctional Nanomaterials for Biomedical Applications discusses sample topics including Fabrication of composites based on lanthanide doped up conversion nanomaterials and metal organic frameworks Photosensitizers for photodynamic therapy PDT covering basic principles of PDT classifications of various photosensitizers mechanisms during treatment and x ray activated PDT Nanomaterials induced pyroptosis and immunotherapy including pyroptosis pathways and their potential in immunotherapy especially in activating effector T cells and promoting dendritic cell maturation Design of ternary quantum dots antibacterial mechanisms in photofunctional antibacterial nanomaterials and inorganic nanomaterials in photothermal therapy Establishing a robust groundwork for the future clinical translation Photofunctional Nanomaterials for Biomedical Applications is an essential up to date reference on the subject for materials scientists photochemists biochemists and electronic engineers **Luminescent Nanomaterials** Odireleng Martin Ntwaeaborwa,2022-05-18 In recent decades luminescent nanomaterials have generated great interest in the scientific community due to their unique properties which are different from those of their bulk counterparts and their use in a wide variety of applications Today luminescent nanomaterials are used in a number of applications such as displays solid state lighting solar cells long afterglow dosimetry theft prevention medical imaging phototherapy and quantum and gas sensing This book presents cutting edge research from experts in the field of synthesis and characterization of luminescent nanomaterials and their potential applications It covers interesting topics in semiconductor physics photochemistry physical chemistry materials science and luminescence and will be useful for beginners and advanced researchers interested in this field **Synthesis and Characterization of Lanthanide Based Nanomaterials for Radiation Detection and Biomedical Applications** Mingzhen Yao,2011 Lanthanide based nanomaterials have shown a great potential in various areas such as luminescence imaging luminescent

labels and detection of cellular functions Due to the f f transitions of the metal ion luminescence of lanthanide ions is characterized by sharp and narrow emissions In this dissertation lanthanide based nanoparticles such as Ce³⁺ Eu³⁺ and other lanthanide ions doped LaF₃ were synthesized their characterization encapsulation and embedding into hybrid matrix were investigated and some of their biomedical and radiological applications were studied DMSO is a common solvent which has been used widely for biological applications LaF₃ Ce nanoparticles were synthesized in DMSO and it was found that their fluorescent emission originates from the metal to ligand charge transfer excited states After conjugation with PpIX and then encapsulation within PLGA the particles show efficient uptake by cancer cells and great cytotoxicity which is promising for applications in cancer treatments However the emission of Eu³⁺ in DMSO is totally different from LaF₃ Ce very strong characteristic luminescence is observed but no emissions from metal to ligand charge transfer excited states as observed in LaF₃ Ce in DMSO Besides it is very interesting to see that the coupling of Eu³⁺ with O H oscillations after water was introduced has an opposite effect on emission peaks at 617 nm and its shoulder peak at 613 nm As a result the intensity ratio of these two emissions has a nearly perfect linear dependence on increasing water concentration in Eu DMSO which provides a very convenient and valuable method for water determination in DMSO Ce³⁺ has been well known as an emitter for radiation detection due to its very short decay lifetime However its emission range limited the environment in which the detection system works Whereas Quantum dots have high luminescence quantum efficiency but their low stopping power results in very weak scintillation luminescence Nanocompounds formed with CdTe quantum dots and LaF₃ Ce nanoparticles optimize both stopping power and scintillation efficiency based on energy transfer from LaF₃ Ce to CdTe Hybrid matrix materials such as ORMOSIL have superior mechanical properties and a better processability than pure molecular material which could be used as carrier of radiation material Moreover embedding a lanthanide complex in a hybrid matrix enhances its thermal stability and luminescence output LaF₃ Ce doped ORMOSIL was synthesized by using two different LaF₃ Ce the nanoparticle doping concentration can reach up to 15.66% while its transparency and luminescent properties were maintained These materials are very promising for radiation detection

Modern Luminescence from Fundamental Concepts to Materials and Applications, Volume 3 Surender Kumar Sharma, Carlos Jacinto da Silva, Daniel Jaque Garcia, Navadeep Shrivastava, 2025-01-01 Modern Luminescence From Fundamental Concepts to Materials and Applications Luminescence in Biomedicine Volume Three is a multi volume work that reviews the fundamental principles properties and applications of luminescent materials Topics addressed include key concepts of luminescence with a focus on important characterization techniques to understand a wide category of luminescent materials the most relevant luminescent materials including transition metals rare earth materials actinide based materials and organic materials emerging applications of luminescent materials in biomedicine solid state devices and the development of hybrid materials Finally the book reviews the latest advances in the application of luminescence and luminescent materials in the field of biomedicine It includes a

review of the use of luminescent nanoparticles and nanomaterials used in diagnosis detection and therapy Future applications are also discussed including nanothermometry nanotechnology in immunotherapy and gene delivery and bio based luminescent sensing and detection Reviews the latest advances of luminescent nanoparticles and nanomaterials for applications in diagnosis detection and therapy in biomedicine Discusses future applications of luminescent nanomedicine including real time sensing biosensing and biodetection Includes an overview of the relevant experimental techniques to characterize the optical materials used for biomedical applications

Upconversion Nanoparticles for Biomedical Applications Kalim Deshmukh, Kevin D. Belfield, Chaudhery Mustansar Hussain, 2025-09-01 Upconversion Nanoparticles for Biomedical Applications provides a comprehensive overview of the chemistry properties characterization and emerging applications of lanthanide doped upconversion nanoparticles UCNPs focusing on upconversion mechanisms fluorescent properties and biomedical applications The emerging applications of UCNPs include cancer diagnostics and therapy biosensing and bioassays bioimaging drug and gene delivery cellular optogenetics and the detection of small biomolecules and ions The biocompatibility biodegradability bio distribution toxicity and regulatory considerations of upconversion are fully considered This book offers a unique reference resource for researchers bringing together a global authorship to cover the fundamentals state of the art current challenges and future perspectives of upconversion nanoparticles Covers the fundamental science and properties of lanthanide doped upconversion nanoparticles UCNPs Explores emerging biomedical applications in areas including drug delivery cancer diagnosis and therapy biosensing and bioimaging Provides a detailed survey of recent research that is invaluable to researchers across multiple academic disciplines and scientists developing new applications in academic and commercial R D contexts

Ionic Liquid-based Synthesis of Luminescent Nanoparticles Ana Kuzmanoski, 2015-11-05 The aim of this thesis is related to synthesis and investigation of different rare earth doped nanomaterials that are prepared via microwave assisted synthesis in ionic liquids ILs The main research has been focused on shifting the excitation wavelength from the UV region to the visible light in order to establish efficient LED phosphors The combination of microwave heating and ionic liquids as reaction media showed superior benefits for the rapid synthesis of different nanomaterials over the conventional heating methods especially in terms of reaction time high crystallinity low defects and thus high quantum yields

Spectroscopy of Lanthanide Doped Oxide Materials Sanjay J. Dhoble, Vijay B. Pawade, Hendrik C. Swart, Vibha Chopra, 2019-10-30 Spectroscopy of Lanthanide Doped Oxide Materials provides a comprehensive overview on the most essential characterization techniques of these materials along with their key applications The book describes the application of optical spectroscopy of lanthanides doped inorganic phosphor hosts and gives information about their structure and morphology binding energies energy of transition and band gap Also discussed are the properties and applications of rare earth doped inorganic materials and the barriers and potential solutions to enable the commercial realization of phosphors in important applications The book reviews key information for those entering the

field of phosphor research along with the fundamental knowledge of the properties of transition series elements under UV Visible NIR light exposers Low cost materials methods to synthesize the materials and spectroscopic characterization methods are also detailed Reviews the barriers and potential solutions to enable commercial realization of inorganic phosphors Discusses low cost material methods to synthesize and characterize lanthanide doped oxide materials Provides readers with a comprehensive overview on key properties for the most relevant applications such as lighting and display energy conversion and solar cell devices *Luminescent Materials in Display and Biomedical Applications* Vikas Dubey, Sudipta Som, Vijay Kumar, 2020-11-18 Luminescent materials with advanced performance are in the research hot spot with the recent technical developments of the display lighting and fluorescence labeling Rare earth doped luminescent materials have been the focus of the research community owing to their wide applications in display devices temperature sensors solar cells biomedical fields optoelectronics etc This book covers the broad aspects of organic and inorganic materials based phosphors The purpose of this book is to provide an up to date account of the present status and advancement of various techniques of synthesis of luminescent materials and their advanced applications in different areas This book will cover all the experimental and theoretical approaches related to the rare earth doped luminescent materials It also contains all the necessary information about the rare earth doped luminescent materials that were used in the past few years In a nutshell this book provides a unique platform to the newcomers who are planning to do research on rare earth doped luminescent materials as well as the researchers who are well established in this field Spectroscopy of Luminescent Nanoparticles and Interactions with Organic Molecules for Imaging and Therapy Daniel Cooper, 2014 The emergence of nanomaterials has had a profound effect on the scientific community reflected in the ever increasing number of dedicated nanojournals Biomedical applications of nanoparticles are numerous and include imaging as luminescent probes or contrast agents biosensing drug and gene delivery and photodynamic therapy PDT among others Luminescent semiconductor nanocrystals known as quantum dots or QDs were among the first varieties produced and remain the most popular choice for imaging due to their versatile optical properties While it has long been recognized that QDs exhibit sensitivity to photoinduced processes involving interactions with organic molecules and oxygen species in aqueous environments results in these complex systems are often contradictory Two of the most popular QD compositions CdSe ZnS and CdTe have redox potentials that permit interactions with relevant chemical species frequently resulting in considerable fluctuations in their spectroscopic properties By conjugating QDs to the small molecule electron donor dopamine DA and using time resolved fluorescence spectroscopy we have studied the dynamics governing photoenhancement of QD luminescence by biomolecule mediated production of reactive oxygen species ROS implicating their involvement through oxygen deprivation and the action of antioxidants This photosensitization was further studied using electron paramagnetic resonance EPR and chemical assays to discern between types of ROS and the consistency of various probes It has been proposed that dense luminescent nanoparticles could also be

used in conjunction with radiation therapy to not only provide dose enhancement but also as a means to improve delivery and indirect activation of PDT agents through scintillation energy transfer While many scintillators have been studied in bulk for radiation detection and other purposes the study of nanoscintillators is in its infancy Current QD preparations despite their notable photostability have poor radiation hardness Luminescent lanthanide doped insulators are among the proposed alternatives as they are relatively biocompatible and chemically stable $\text{CeLa}_1\text{x}\text{F}_3$ is a heavy fast scintillator that shows promise for radiation assisted PDT but exhibits complex luminescence mechanisms that depend highly on the crystalline quality and Ce_3 dopant concentration We report novel synthesis techniques and surface chemistry for $\text{CeO}_1\text{La}_0.9\text{F}_3$ LaF_3 and CeF_3 LaF_3 core shell nanoparticles and explore their mechanisms of photoluminescence as well as energy transfer to bound and unbound photosensitizer molecules in aqueous solutions We found that Ce_3 excitation efficiently relays energy to photosensitizers through a multi step cascade results that have important implications for the design of nanoscintillator systems

Photon Upconversion Nanomaterials Fan Zhang, 2014-12-11 This book introduces the latest advances made in both fundamental studies and potential applications of upconversion nanomaterials particularly in the field of high resolution in vitro bioanalysis and in vivo imaging This book starts with the synthesis and characterization and focuses on applications ranging from materials science to biology Above all it describes cutting edge advances in upconversion nanophosphor UCNP based applications in multiplexed encoding guest delivery and release systems photodynamic therapy PDT solar cells photocatalysis and so on The major barriers that currently prevent UCNPs from being used in mainstream applications are also presented in detail

Lanthanide Luminescence Pekka Hänninen, Harri Härmä, 2013-01-02 Lanthanides have fascinated scientists for more than two centuries now and since efficient separation techniques were established roughly 50 years ago they have increasingly found their way into industrial exploitation and our everyday lives Numerous applications are based on their unique luminescent properties which are highlighted in this volume It presents established knowledge about the photophysical basics relevant lanthanide probes or materials and describes instrumentation related aspects including chemical and physical sensors The uses of lanthanides in bioanalysis and medicine are outlined such as assays for in vitro diagnostics and research All chapters were compiled by renowned scientists with a broad audience in mind providing both beginners in the field and advanced researchers with comprehensive information on the given subject

Highly Luminescent Lanthanide Complexes with Specific Coordination Structures Kohei Miyata, 2014-04-08 This thesis deals with strongly luminescent lanthanide complexes having novel coordination structures Luminescent lanthanide complexes are promising candidates as active materials for EL devices lasers and bio sensing applications The organic ligands in lanthanide complexes control geometrical and vibrational frequency structures that are closely related to the luminescent properties In most of the previous work however lanthanide complexes have high vibrational frequency C H units close to the metal center for radiationless transition In this thesis the luminescent properties of lanthanide complexes

with low vibrational frequency C F and P O units are elucidated in terms of geometrical vibrational and chemical structures The author also describes lanthanide coordination polymers with both high thermal stability decomposition point 300 C and strong luminescent properties emission quantum yield 80% The author believes that novel studies on the characteristic structures and photophysical properties of lanthanide complexes may open up a frontier field in photophysical coordination and material chemistry *Fluorescent Nanodiamonds* Huan-Cheng Chang, Wesley Wei-Wen Hsiao, Meng-Chih Su, 2018-09-12

The most comprehensive reference on fluorescent nanodiamond physical and chemical properties and contemporary applications Fluorescent nanodiamonds FNDs have drawn a great deal of attention over the past several years and their applications and development potential are proving to be manifold and vast The first and only book of its kind Fluorescent Nanodiamonds is a comprehensive guide to the basic science and technical information needed to fully understand the fundamentals of FNDs and their potential applications across an array of domains In demonstrating the importance of FNDs in biological applications the authors bring together all relevant chemistry physics materials science and biology Nanodiamonds are produced by powerful cataclysmic events such as explosions volcanic eruptions and meteorite impacts They also can be created in the lab by high pressure high temperature treatment of graphite or detonating an explosive in a reactor vessel A single imperfection can give a nanodiamond a specific isolated color center which allows it to function as a single trapped atom Much smaller than the thickness of a human hair a nanodiamond can have a huge surface area that allows it to bond with a variety of other materials Because of their non toxicity nanodiamonds may be useful in biomedical applications such as drug delivery and gene therapy The most comprehensive reference on a topic of rapidly increasing interest among academic and industrial researchers across an array of fields Includes numerous case studies and practical examples from many areas of research and industrial applications as well as fascinating and instructive historical perspectives Each chapter addresses in depth a single integral topic including the fundamental properties synthesis mechanisms and functionalisation of FNDs The first book published by the key patent holder with his research group in the field of FNDs Fluorescent Nanodiamonds is an important working resource for a broad range of scientists and engineers in industry and academia It will also be a welcome reference for instructors in chemistry physics materials science biology and related fields *Luminescent Materials and Their Applications* Hardev Singh Virk, 2015 [Multifunctional Platforms Based on Upconversion Nanoparticles for Applications in Nanomedicine](#) Karina Nigoghossian, 2018 In the biomedical field there is an increasing demand for multifunctional nanosystems to perform imaging and therapy simultaneously aiming at early diagnosis and maximum therapeutic benefit Upconversion nanoparticles UCNPs have been proposed as an ideal bio probe because of their unique advantages related to the upconversion phenomenon presented by materials containing lanthanide ions e g visible emission obtained under near infrared NIR excitation such as deep tissue penetration low autofluorescence background and low photo damage Moreover the luminescent properties of lanthanide ions may be used for thermometry

because of a strongly temperature dependent effect Luminescence nanothermometry is a noncontact and high resolution technique that has been gaining attention in nanomedicine since temperature is a fundamental parameter in events that occur in cells The thermal damage of cells may be locally photoinduced by using metal nanostructures illuminated at their localized surface plasmon resonance LSPR band because of the enhancement of light absorption In this work a multifunctional system was designed combining gold nanoshells AuNSs and UCNPs intended as an optical heater and temperature probe at the nanoscale This system was studied aiming its application as an agent for photothermal therapy PTT guided by the thermometer capacity of UCNPs which allows to optimize the therapeutic benefits The synthesis of NaGdF₄ UCNPs doped with ions Yb³⁺ Er³⁺ was performed via the thermal decomposition of lanthanide ion fluoride precursors at high temperatures 300 °C in the presence of a coordinating ligand oleic acid UCNPs were synthesized at three different temperatures 310 315 and 320 °C and characterized in terms of morphological structural and emission properties In view of the intended biological applications the surface of hydrophobic oleate capped UCNPs was modified by a silica coating to achieve sufficient water dispersibility through a modified Stober process by a reverse micro emulsion method Monodisperse NaGdF₄ Yb³⁺ Er³⁺ upconverting nanocrystals 25 nm dia were obtained in cubic at 310 315 °C and hexagonal phase at 320 °C The UCNPs in the hexagonal phase showed to be more suitable for application as a temperature sensor because of its lower red to green emission ratio and higher thermal sensitivity The emission spectra of NaGdF₄ Yb³⁺ Er³⁺ oleate or silica coated UCNPs were measured at different temperatures in the vicinity of the physiological temperature range 20–70 °C and presented suitable properties for application as a temperature sensor such as excellent linearity R² 0.99 and sensitivity 3.10 K⁻¹ The surface of AuNSs were decorated with silica coated UCNPs The heating capacity of such nanocomposites AuNSs UCNPs was verified by monitoring the Er³⁺ emission enabling potential application as a hyperthermia agent controlled by the nanothermometer function In a second part of this thesis a multifunctional nanosystem was designed and applied as a dual sensor of ultraviolet UV light and temperature Eu(tta)₃ thenoyltrifluoroacetate complex was prepared in situ over the silica shell of NaGdF₄ Yb³⁺ Er³⁺ UCNPs A dual mode nanothermometer UV sensor was obtained from the combination of NIR to visible upconversion fluorescence signal of Er³⁺ ions and the UV excited downshifted emission from the Eu(tta)₃ complex Measurements were performed near the physiological temperature range 20–50 °C revealing excellent linearity R² 0.99 and relatively high thermal sensitivities 1.5% K⁻¹ The Eu(tta)₃ complex present in the silica shell was also demonstrated as a UV sensor because of the Eu³⁺ luminescence dependence on UV light exposure The obtained material shows potential for application in light activated therapies such as photodynamic therapy PDT and PTT which typically require UV or blue light for excitation The control of light dose released to the tissue is of great importance in these therapeutic procedures to avoid photodamage to the surroundings The thermometer function is useful to guide such therapeutic processes PDT and PTT synergistically with the UV dosimeter

Whispering the Secrets of Language: An Mental Journey through **Lanthanide Doped Luminescent Nanomaterials From Fundamentals To Bioapplications Nanomedicine And Nanotoxicology**

In a digitally-driven earth wherever screens reign supreme and instant transmission drowns out the subtleties of language, the profound strategies and emotional subtleties hidden within phrases frequently move unheard. Yet, located within the pages of **Lanthanide Doped Luminescent Nanomaterials From Fundamentals To Bioapplications Nanomedicine And Nanotoxicology** a charming literary value pulsing with raw emotions, lies a fantastic quest waiting to be undertaken. Published by an experienced wordsmith, that marvelous opus attracts readers on an introspective trip, softly unraveling the veiled truths and profound impact resonating within ab muscles material of every word. Within the mental depths of this moving review, we shall embark upon a genuine exploration of the book is core subjects, dissect its charming publishing fashion, and yield to the effective resonance it evokes deep within the recesses of readers hearts.

http://www.armchairempire.com/public/detail/index.jsp/haynes_manual_for_renault_clio_expression.pdf

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