

1. Record Nr.	UNINA9910920927003321
Autore	Li Chunxia
Titolo	Photofunctional Nanomaterials for Biomedical Applications
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2025 ©2025
ISBN	9783527845330 352784533X 9783527845347 3527845348 9783527845323 3527845321
Edizione	[1st ed.]
Descrizione fisica	1 online resource (588 pages)
Altri autori (Persone)	LinJun
Disciplina	610.284
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- Foreword -- Preface -- Acknowledgments -- Chapter 1 General Introduction and Background of Photofunctional Nanomaterials in Biomedical Applications -- 1.1 Introduction to Nanomaterials -- 1.1.1 Surface and Interfacial Effects -- 1.1.2 Small Size Effect -- 1.1.3 Quantum Size Effect -- 1.1.4 Macroscopic Quantum Tunneling Effects -- 1.2 Introduction and Classification of Photofunctional Nanomaterials -- 1.2.1 Capture of Photons -- 1.2.2 Absorption and Conversion of Photons -- 1.2.3 Physicalchemical Processes at the Surface Interface -- 1.3 Introduction to Nanobiomedicine -- 1.3.1 Nanodrug Delivery Systems -- 1.3.2 Nanoimaging Technology -- 1.3.3 Nanodiagnostic Technologies -- 1.3.4 Nanotherapeutic Technology -- 1.3.5 Nano biosensors -- 1.3.6 Tissue Engineering -- 1.4 Classification of Photofunctional Nanomaterials -- 1.4.1 Fluorescent Nanomaterials -- 1.4.1.1 Quantum Dots -- 1.4.1.2 SiliconBased Fluorescent Nanomaterials -- 1.4.1.3 Rare Earth Luminescent Nanomaterials -- 1.4.1.4 Organic Fluorescent Nanomaterials -- 1.4.2 Photothermal Nanomaterials -- 1.4.2.1 Metallic Photothermal Nanomaterials --

1.4.2.2 Semiconductor Photothermal Nanomaterials -- 1.4.2.3 Organic Photothermal Nanomaterials -- 1.4.2.4 CarbonBased Photothermal Nanomaterials -- 1.4.2.5 Certain TwoDimensional (2D) Nanomaterials -- 1.4.2.6 Biomass Photothermal Nanomaterials -- 1.4.3 Photodynamic Nanomaterials -- 1.4.3.1 PhotosensitizerLoaded Nanomaterials -- 1.4.3.2 Nanomaterials with Intrinsic Photodynamic Effects -- 1.4.3.3 Energy Conversion Nanomaterials for Photosensitizers -- 1.4.4 Photoelectrochemical Nanomaterials -- 1.4.4.1 Photocurrent Signal Generation Mechanism -- 1.4.4.2 Core Elements of Photoelectrochemical Biosensors -- 1.4.4.3 Types of Photoelectrochemical Biosensors -- 1.4.5 Photoacoustic Nanomaterials. 1.4.5.1 Introduction to Photoacoustic Imaging -- 1.4.5.2 Selection of Photoacoustic Contrast Agents -- 1.5 Conclusion -- References -- Chapter 2 Mechanism in RareEarthDoped Luminescence Nanomaterials -- 2.1 Introduction -- 2.2 Composition of REDoped Luminescence Nanomaterials: Substrate (Host), Activator, and Sensitizer -- 2.3 Mechanism of REDoped Luminescence Nanomaterials -- 2.3.1 Luminescence: Downshifting, Upconversion, and Downconversion -- 2.3.1.1 Downshifting Luminescence -- 2.3.1.2 Upconversion Luminescence (UCL) -- 2.3.1.3 Downconversion/Quantum Cutting (QC) -- 2.3.2 Nonradiative Transition: Energy Transfer and Migration -- 2.3.2.1 Energy Transfer (ET) -- 2.3.2.2 Energy Migration (EM) -- 2.4 Luminescence Modulation -- 2.4.1 Crystal Field (CF) Regulation -- 2.4.2 Surface Defects Passivation -- 2.4.3 ET Regulation -- 2.4.3.1 Multicolor Tuning (MCT) of UCL -- 2.4.3.2 Energy Transfer-Triggered Novel Upconversion Excitation -- 2.4.4 CrossRelaxation (CR) Regulation -- 2.4.4.1 Alleviating Concentration Quenching (CQ) for Highly Doped UCNPs -- 2.4.4.2 NIR Downshifting Modulation by CR -- 2.4.5 PhononAssisted Energy Transfer (PAET) -- 2.4.6 Dye Sensitization -- 2.4.6.1 DyeSensitized Core Nanoparticles -- 2.4.6.2 DyeSensitized Core-Shell Nanoparticles -- 2.4.7 Combined Excitation Regulation -- 2.4.7.1 ESA -- 2.4.7.2 STED -- 2.4.8 External Field Modulation -- 2.4.8.1 Magnetic Field Modulation -- 2.4.8.2 Electric Field Modulation -- 2.4.8.3 Plasma Resonance Enhancement -- References -- Chapter 3 Upconversion and NIRII Luminescence Modulation of RareEarth Composites Using Material Informatics -- 3.1 Introduction -- 3.2 Typical Processes of Upconversion Luminescence -- 3.2.1 Excited State Absorption -- 3.2.2 Photon Avalanche -- 3.2.3 Energy Transfer -- 3.2.4 CrossRelaxation -- 3.2.5 Cooperative Upconversion -- 3.2.6 Second Harmonic Generation. 3.3 Synthesis Methods of Upconversion Nanoparticles -- 3.3.1 Thermal Decomposition Methods -- 3.3.2 Hydrothermal/Solvothermal Method -- 3.3.3 Coprecipitation Method -- 3.3.4 Sol-Gel Method -- 3.3.5 Other Methods -- 3.4 Material Informatics in UCL -- 3.4.1 Genetic Algorithm -- 3.4.2 Particle Swarm Optimization -- 3.4.3 Simulated Annealing -- 3.4.4 Other Methods -- 3.5 Cancer Therapy Based on UCNPs -- 3.5.1 Photodynamic Therapy -- 3.5.2 Photothermal Therapy -- 3.5.3 Photolmmunotherapy -- 3.5.4 PhotoGene Therapy -- 3.6 Conclusion and Perspective -- References -- Chapter 4 Composites Based on LanthanideDoped Upconversion Nanomaterials and Metal Organic Frameworks: Fabrication and Bioapplications -- 4.1 Introduction -- 4.2 Fabrications of Composites -- 4.2.1 In Situ Encapsulation -- 4.2.2 Partial Embedment -- 4.2.3 Interfacial Attachment -- 4.3 Bioapplications -- 4.3.1 Therapy -- 4.3.2 Bioimaging -- 4.3.3 Biosensing -- 4.4 Conclusion and Perspectives -- References -- Chapter 5 LanthanideDoped Nanomaterials for Luminescence Biosensing and Biodetection -- 5.1 Introduction -- 5.2 Basics of Optical Bioprobe and LanthanideDoped Nanoparticles --

5.2.1 Design Considerations for Bioprobe Development -- 5.2.2 Characteristics of Lanthanide Doped Nanoparticles -- 5.2.3 NIR Biological Windows -- 5.2.4 Energy Transfer: A Key Factor in Biodetection -- 5.3 Synthesis and Functionalization of Lanthanide Doped Nanocrystals -- 5.3.1 Design and Synthesis of Core-Shell Structured Nanocrystals -- 5.3.1.1 Design of Upconversion Nanoparticles (UCNPs) -- 5.3.1.2 Design of Downshifting Nanoparticles (DSNPs) -- 5.3.2 Functionalization of Lanthanide Doped Nanoparticles (LnNPs) -- 5.3.2.1 Amphiphilic Polymer Adsorption -- 5.3.2.2 Ligand Removal -- 5.3.2.3 Ligand Exchange -- 5.3.2.4 Surface Silanization -- 5.4 Applications of Luminescence Biosensing and Biodetection. 5.4.1 Temperature Sensing -- 5.4.2 pH Sensing -- 5.4.3 Detection of Biomolecules -- 5.4.4 Detection of Small Molecules and Ions -- 5.5 Integrated Devices for Point-of-Care Testing -- 5.6 Summary -- References -- Chapter 6 Rare Earth Luminescent Nanomaterials for Gene Delivery -- 6.1 Introduction -- 6.2 UCNPs Nanovectors -- 6.3 Surface Modification -- 6.3.1 Silica -- 6.3.2 Cationic Polymers -- 6.4 Increasing Endosomal Escape -- 6.5 Controlling Delivery Strategy -- 6.5.1 Photodegradable Polymers -- 6.5.2 Changes in Carrier Surface Charge -- 6.5.3 Photoisomerization -- 6.5.4 Microenvironments Stimulation -- 6.5.4.1 Reactive Oxygen Species (ROS) -- 6.5.4.2 Matrix Metalloproteinases (MMPs) -- 6.5.5 Light Cage -- 6.5.6 Orthogonal Control -- 6.5.7 Release Monitoring -- 6.6 Gene Therapy and Syndication -- 6.6.1 Phototherapy -- 6.6.2 Chemotherapy -- 6.7 Other Lanthanide Based Nanovectors -- 6.8 Perspective -- References -- Chapter 7 Biosafety of Rare Earth Doped Nanomaterials -- 7.1 Internalization of UCNPs into Cells -- 7.2 Distribution of UCNPs -- 7.3 Excretion Behavior of UCNPs -- 7.4 The Toxic Effect of Cell Incubated with UCNPs -- 7.5 Toxic Effect of UCNPs In Vivo -- 7.6 Conclusions and Prospects -- References -- Chapter 8 Design and Construction of Photosensitizers for Photodynamic Therapy of Tumor -- 8.1 Introduction -- 8.2 Small Molecule Photosensitizers -- 8.2.1 Porphyrins -- 8.2.2 Phthalocyanines -- 8.2.3 BODIPYs -- 8.2.4 Indocyanine Dyes -- 8.2.5 AIEgens -- 8.3 Metal Complexes -- 8.3.1 Ru(II) Complexes -- 8.3.2 Ir(III) Complexes -- 8.3.3 MOFs -- 8.3.4 COFs -- 8.3.5 HOFs -- 8.4 Inorganic Photosensitizers -- 8.4.1 Carbon Based Photosensitizers -- 8.4.2 Silicon Based Photosensitizers -- 8.4.3 Simple Substance Photosensitizers -- 8.4.4 Metal Oxides Based Photosensitizers -- 8.4.5 Lanthanide Upconversion Nanoparticles Based PSs. 8.5 Conclusions and Perspectives -- References -- Chapter 9 Persistent Luminescent Materials for Optical Information Storage Applications -- 9.1 Introduction -- 9.2 Luminescent Mechanism of Persistent Luminescent Materials with Deep Traps -- 9.3 Persistent Luminescent Materials with Deep Traps -- 9.3.1 Halides or Oxyhalides -- 9.3.2 Sulfides -- 9.3.3 Oxides -- 9.3.3.1 Monobasic Cation Oxide -- 9.3.3.2 Silicate/Germanate/Stannate -- 9.3.3.3 Aluminate/Gallate -- 9.3.3.4 Titanate/Zirconate -- 9.3.3.5 Oxide Glass -- 9.3.4 Nitride or Oxynitrides -- 9.4 Outlooks -- References -- Chapter 10 The Application of Ternary Quantum Dots in Tumor Related Marker Detection, Imaging, and Therapy -- 10.1 Introduction -- 10.1.1 Fundamental Properties of QDs -- 10.1.2 Synthesis Methods of QDs -- 10.1.2.1 Metal Organic Synthesis Method -- 10.1.2.2 Hydrophilic Synthesis Method -- 10.1.2.3 Biosynthesis Method -- 10.1.3 Synthesis Methods of Ternary QDs -- 10.1.3.1 Hot Injection Method -- 10.1.3.2 Ion Exchange Method -- 10.1.3.3 Hydrothermal Method -- 10.1.4 Performance Control of QDs -- 10.1.4.1 Core-Shell Structure -- 10.1.4.2 Alloying -- 10.1.4.3 Ionizing -- 10.1.5 Modification of QDs -- 10.1.5.1 Surfacing Ligand Molecular Exchange -- 10.1.5.2 Amphiphilic

Organic Macromolecular Coating -- 10.1.6 Characterization of QDs --
10.1.7 Biomedical Applications of QDs -- 10.1.7.1 Biological Detection
-- 10.1.7.2 Cell Imaging -- 10.1.7.3 Live Imaging -- 10.1.7.4 Tumor
Therapy -- 10.2 Conclusion -- References -- Chapter 11
NanomaterialsInduced Pyroptosis and Immunotherapy -- 11.1
Discovery and Definition of Pyroptosis -- 11.2 Mechanisms of
Pyroptosis -- 11.2.1 Inflammasome and Pyroptosis -- 11.2.2
Caspases, Gasdermins, and Pyroptosis -- 11.3 Pyroptosis and Tumor
Immunotherapy -- 11.3.1 Ions Interference Therapy -- 11.3.2 TME
Responsive Pyroptosis Therapy.
11.3.3 DemethylationActivated Pyroptosis.
