

# Semiconductor Gas Sensors Woodhead Publishing

Semiconductor Gas Sensors Semiconducting Metal Oxides for Gas Sensing Chemical  
Sensors XAFS Techniques for Catalysts, Nanomaterials, and Surfaces Metal Oxide-Based  
Heterostructures Tin Oxide Materials 21st Century Nanostructured Materials Advanced  
Functional Materials for Optical and Hazardous Sensing Environmental Applications of  
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Rakesh Kumar Sonker Shadpour Mallakpour Arthur James Wells  
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semiconductor gas sensors have a wide range of applications in safety process control  
environmental monitoring indoor or cabin air quality and medical diagnosis this important  
book summarises recent research on basic principles new materials and emerging  
technologies in this essential field the first part of the book reviews the underlying  
principles and sensing mechanisms for n and p type oxide semiconductors introduces the  
theory for nanosize materials and describes the role of electrode semiconductor interfaces  
the second part of the book describes recent developments in silicon carbide and

graphene based gas sensors wide bandgap semiconductor gas sensors and micromachined and direct thermoelectric gas sensors part 3 discusses the use of nanomaterials for gas sensing including metal oxide nanostructures quantum dots single walled carbon nanotubes and porous silicon the final part of the book surveys key applications in environmental monitoring detecting chemical warfare agents and monitoring gases such as carbon dioxide semiconductor gas sensors is a valuable reference work for all those involved in gas monitoring including those in the building industry environmental engineers defence and security specialists and researchers in this field provides an overview of resistor and non resistor sensors reviews developments in gas sensors and sensing methods including graphene based sensors and direct thermoelectric sensors discusses the use of nanomaterials in gas sensing

the second edition of this book focuses on the synthesis design and application of semiconducting metal oxides as gas sensing materials including the gas sensing mechanism and modification methods for sensing materials while also providing a comprehensive introduction to semiconductor gas sensing devices as an essential part of internet of things gas sensors have shown great significance and promising prospects therefore studies on functional mesoporous metal oxides one of the most important gas sensing materials based on their unique knudsen diffusion behavior and tailored pore structure have increasingly attracted attention from various disciplines the book offers a valuable reference guide to metal oxide gas sensing materials for undergraduate and graduate students alike it will also benefit all researchers who are involved in synthesis and gas sensing of metal oxides nanomaterials with relevant frontier theories and concepts engineers working on research and development of semiconductor gas sensors will also find some new ideas for sensor design

chemical sensors contain two basic functions recognition and transduction and provide real time information about substances rather than physical quantities such devices are extensively utilized for various applications in diverse fields the book focuses on the physical chemical optical and electrical working mechanisms of different types of sensors integrated with various smart nanomaterials and composites the mesmerizing properties of numerous materials and their fruitful applications for detecting numerous chemical parameters are discussed here the book provides recent progress in the chemical sensors field and connects materials physics chemistry and engineering and therefore is suitable for engineers industrial and academic researchers

this book is a comprehensive theoretical practical and thorough guide to xafs spectroscopy the book addresses xafs fundamentals such as experiments theory and data analysis advanced xafs methods such as operando xafs time resolved xafs spatially resolved xafs total reflection xafs high energy resolution xafs and practical applications to a variety of catalysts nanomaterials and surfaces this book is accessible to a broad audience in academia and industry and will be a useful guide for researchers entering the subject and graduate students in a wide variety of disciplines

metal oxide based heterostructures fabrication and applications provides information on synthesis strategies structural and hierarchical features morphological characteristics of metal oxide based heterostructures and their diverse applications this book begins with an introduction to the various multidimensional heterostructures synthesis aspects and techniques used to control the formation of heterostructures then the impact of synthesis routes on the formation of mixed metal oxide heterostructures and their properties are analyzed the effect of nonmetal doping metal doping and composites of metal oxide heterostructures on the properties of heterostructures is also addressed and that also includes opportunities for optimization of the material s performance for specific applications special attention is given to the surface characteristics of the metal oxide heterostructures and their impact on the material s performance and the applications of metal oxide heterostructures in various fields such as environmental remediation sensing organic catalysis photovoltaics light emitting materials and hydrogen production introduces key principles for metal oxide heterostructures their properties key characteristics and synthesis routes emphasizes the relationship between synthesis strategies and material performance including optimization strategies such as tailoring the material s surface characteristics or structure discusses metal oxide heterostructures and their application in lighting and displays energy environment and sensing

tin oxide materials synthesis properties and applications discusses the latest in metal oxides an emerging area in electronic materials as more is learned about this important materials system more functionalities and applications have been revealed this key reference on the topic covers important material that is ideal for materials scientists materials engineers and materials chemists who have been introduced to metal oxides as a general category of materials but want to take the next step and learn more about a specific material provides a complete resource on tin oxide materials systems including in depth discussions of properties their synthesis modelling methods and applications presents information on the well investigated  $\text{SnO}_2$  but also includes discussions on its

emerging stoichiometries such as  $\text{SnO}$  and  $\text{Sn}_3\text{O}_4$  includes the most relevant applications in varistors sensing devices fuel cells transistors biological studies and much more

nanstructured materials nms are attracting interest as low dimensional materials in the high tech era of the 21st century recently nanomaterials have experienced breakthroughs in synthesis and industrial and biomedical applications this book presents recent achievements related to nms such as graphene carbon nanotubes plasmonic materials metal nanowires metal oxides nanoparticles metamaterials nanofibers and nanocomposites along with their physical and chemical aspects additionally the book discusses the potential uses of these nanomaterials in photodetectors transistors quantum technology chemical sensors energy storage silk fibroin composites drug delivery tissue engineering and sustainable agriculture and environmental applications

this book highlights the significance and usefulness of nanomaterials for the development of sensing devices and their real life applications the book also addresses various means of synthesizing functional materials e g hydrothermal deposition process electrospinning ostwald ripening sputtering heterogeneous deposition liquid phase preparation the vapor deposition approach and aerosol flame synthesis it presents an informative overview of the role of functional materials in the development of advanced sensor devices at the nanoscale and discusses the applications of functional materials in different forms prepared by diverse techniques in the field of optoelectronics and biomedical devices major features such as type of advanced functional fabrication methods applications tasks benefits and restrictions and saleable features are presented in this book advanced functional materials for sensing have much wider applications and have an enormous impact on our environment

environmental applications of carbon nanomaterials based devices explore this insightful treatment of the function and fabrication of high performance devices for environmental applications environmental applications of carbon nanomaterials based devices delivers an overview of state of the art technology in functionalized carbon nanomaterials based devices for environmental applications the book provides a powerful foundation based in materials science on functionalized carbon nanomaterials in general and environmental science and device fabrication in particular the book focuses on the chemical and physical methods of functionalization of carbon nanomaterials and the technology of device fabrication including lab on a chip approaches and applications such as wastewater purification and gas sensing it provides readers with a thorough understanding of effective

environmental remediation techniques performed with carbon nanomaterials based devices in addition to topics such as cross linked graphene oxide membranes assembled with graphene oxide nanosheets free standing graphene oxide chitin nanocrystal composite membranes for dye adsorption and oil water separation and in situ grown covalent organic framework nanosheets on graphene for membrane based dye salt separation readers will also benefit from the inclusion of a thorough introduction to charge gated ion transport through polyelectrolyte intercalated amine reduced graphene oxide membranes an exploration of hydrotalcite graphene oxide hybrid nanosheets functionalized nanofiltration membrane for desalination a discussion of the incorporation of attapulgite nanorods into graphene oxide nanofiltration membranes for efficient dyes wastewater treatment an examination of attapulgite nanofibers and graphene oxide composite membranes for high performance molecular separation perfect for materials scientists analytical chemists and environmental chemists environmental applications of carbon nanomaterials based devices will also earn a place in the libraries of sensor developers seeking a one stop resource for high performance devices and sensors useful for environmental applications

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