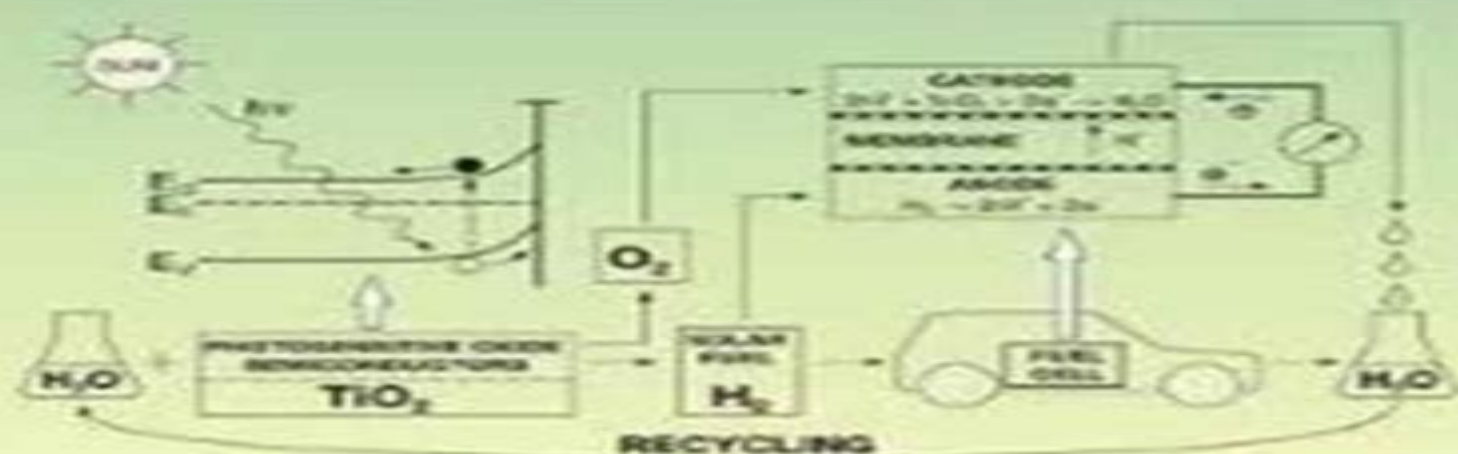


Oxide Semiconductors for Solar Energy Conversion

Titanium Dioxide



Janusz Nowotny

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M Lipman

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Oxide Semiconductors for Solar Energy Conversion Janusz Nowotny, 2011-09-06 Oxide semiconductors including titanium dioxide TiO_2 are increasingly being considered as replacements for silicon in the development of the next generation of solar cells Oxide Semiconductors for Solar Energy Conversion Titanium Dioxide presents the basic properties of binary metal oxide semiconductors and the performance related properties of TiO_2 as they relate to solar energy The book provides a general background on oxide semiconductors based on binary oxides and their solid solutions including electronic and ionic conductors It covers several aspects of solid state electrochemistry of oxides such as defect chemistry and defect related properties such as electrical properties diffusion segregation and reactivity The author also takes a pioneering approach in considering bulk versus surface semiconducting properties showing how they are different due to the effect of segregation One of the first on semiconducting photocatalytic and photoelectrochemical properties of TiO_2 and its solid solutions with donor and acceptor type ions the book discusses defect chemistry of TiO_2 in terms of defect equilibria and defect related properties including electrical properties self and chemical diffusion surface properties segregation and reactivity and photoreactivity with oxygen water and microbial agents The text also illustrates the use of TiO_2 as an emerging material for solar energy conversion systems including the generation of hydrogen fuel by photoelectrochemical water splitting the photocatalytic purification of water and the generation of photovoltaic electricity In addition it presents defect disorder diagrams for the formation of TiO_2 based semiconductors with controlled properties Encompassing the areas of solid state science surface chemistry and photocatalysis this book reflects the increasing awareness of the importance of structural imperfections such as point defects in understanding the properties of metal oxides specifically TiO_2 based semiconductors

Oxide Semiconductors for Solar-to-Chemical Energy Conversion Venkataraman Thangadurai, Yasuro Ikuma, 2016-08-16 Special topic volume with invited peer reviewed papers only **Mixed Metal Oxide Semiconductors and Electrocatalyst Materials for Solar Energy Conversion** Sean Patrick Berglund, 2013 The sun is a vast source of renewable energy which can potentially be used to satisfy the world's increasing energy demand Yet many material challenges need to be overcome before solar energy conversion can be implemented on a larger scale This dissertation focuses on materials used for solar energy conversion through photoelectrochemical PEC processes It discusses methods for improving PEC materials namely mixed metal oxide semiconductors by nanostructuring incorporation of additional elements and application surface electrocatalysts In this dissertation several material synthesis techniques are detailed A high vacuum synthesis process known as reactive ballistic deposition RBD is used to synthesize nanostructured bismuth vanadate BiVO_4 which is studied for PEC water oxidation Additionally ballistic deposition BD is used to incorporate Mo and W into nanostructured BiVO_4 to improve the PEC activity An array dispenser and scanner system is used to incorporate metals into copper oxide CuO and copper bismuth oxide CuBi_2O_4 and over 3 000 unique material compositions are tested for cathodic photoactivity The system

is also used to test 35 elements as single component metal oxides mixed metal oxides and dopants for titanium dioxide TiO₂ for use in dye sensitized solar cells DSCs Lastly RBD is used to deposit tungsten semicarbide W₂C onto p type silicon p type substrates as an electrocatalyst for PEC proton reduction In many cases the synthesis techniques and new material combinations presented in this dissertation result in improved PEC performance The materials are thoroughly assessed and characterized to gain insights into their nanostructure chemical composition light absorption charge transport properties catalytic activity and stability

Solar Energy Update ,1984 Directory of Solar Energy Research Activities in the United States ,1980 *Energy: a Continuing Bibliography with Indexes* ,1981 *Energy* ,1976 **Solar Energy** United States. Energy Research and Development Administration. Technical Information Center,1976 *Nanostructured Semiconductor Oxides for the Next Generation of Electronics and Functional Devices* Serge Zhuiykov,2014-02-14

Nanostructured Semiconductor Oxides for the Next Generation of Electronics and Functional Devices focuses on the development of semiconductor nanocrystals their technologies and applications including energy harvesting solar cells solid oxide fuel cells and chemical sensors Semiconductor oxides are used in electronics optics catalysts sensors and other functional devices In their 2D form the reduction in size confers exceptional properties useful for creating faster electronics and more efficient catalysts After explaining the physics affecting the conductivity and electron arrangement of nanostructured semiconductors the book addresses the structural and chemical modification of semiconductor nanocrystals during material growth It then covers their use in nanoscale functional devices particularly in electronic devices and carbon nanotubes It explores the impact of 2D nanocrystals such as graphene chalcogenides and oxide nanostructures on research and technology leading to a discussion of incorporating graphene and semiconductor nanostructures into composites for use in energy storage The final three chapters focus on the applications of these functional materials in photovoltaic cells solid oxide fuel cells and in environmental sensors including pH dissolved oxygen dissolved organic carbon and dissolved metal ion sensors *Nanostructured Semiconductor Oxides for the Next Generation of Electronics and Functional Devices* is a crucial resource for scientists applied researchers and production engineers working in the fabrication design testing characterization and analysis of new semiconductor materials This book is a valuable reference for those working in the analysis and characterization of new nanomaterials and for those who develop technologies for practical devices fabrication Focuses on the development of semiconductor nanocrystals their technologies and applications including energy harvesting solar cells solid oxide fuel cells and chemical sensors Reviews fundamental physics of conductivity and electron arrangement before proceeding to practical applications A vital resource for applied researchers and production engineers working with new semiconductor materials

Encyclopedia of Electrochemical Power Sources ,2024-10-03 The Encyclopedia of Electrochemical Power Sources Second Edition is a comprehensive seven volume set that serves as a vital interdisciplinary reference for those working with batteries fuel cells electrolyzers supercapacitors and photo electrochemical cells With an

increased focus on the environmental and economic impacts of electrochemical power sources this work not only consolidates extensive coverage of the field but also serves as a gateway to the latest literature for professionals and students alike The field of electrochemical power sources has experienced significant growth and development since the first edition was published in 2009 This is reflected in the exponential growth of the battery market the improvement of many conventional systems and the introduction of new systems and technologies This completely revised second edition captures these advancements providing updates on all scientific technical and economic developments over the past decade Thematically arranged this edition delves into crucial areas such as batteries fuel cells electrolyzers supercapacitors and photo electrochemical cells It explores challenges and advancements in electrode and electrolyte materials structural design optimization application of novel materials and performance analysis This comprehensive resource with its focus on the future of electrochemical power sources is an essential tool for navigating this rapidly evolving field Covers the main types of power sources including their operating principles systems materials and applications Serves as a primary source of information for electrochemists materials scientists energy technologists and engineers Incorporates 365 articles with timely coverage of environmental and sustainability aspects Arranged thematically to facilitate easy navigation of topics and easy exploration of the field across its key branches Follows a consistent structure and features elements such as key objective boxes summaries figures references and cross references etc to help students faculty and professionals alike

Energy Research Abstracts ,1978-02 Encyclopedia of Renewable Energy, Sustainability and the Environment ,2024-08-09

Encyclopedia of Renewable Energy Sustainability and the Environment Four Volume Set comprehensively covers all renewable energy resources including wind solar hydro biomass geothermal energy and nuclear power to name a few In addition to covering the breadth of renewable energy resources at a fundamental level this encyclopedia delves into the utilization and ideal applications of each resource and assesses them from environmental economic and policy standpoints This book will serve as an ideal introduction to any renewable energy source for students while also allowing them to learn about a topic in more depth and explore related topics all in a single resource Instructors researchers and industry professionals will also benefit from this comprehensive reference Covers all renewable energy technologies in one comprehensive resource Details renewable energies processes from production to utilization in a single encyclopedia Organizes topics into concise consistently formatted chapters perfect for readers who are new to the field Assesses economic challenges faced to implement each type of renewable energy Addresses the challenges of replacing fossil fuels with renewables and covers the environmental impacts of each renewable energy

Semiconductor Devices and Integrated Electronics A. G. Milnes,2012-12-06 For some time there has been a need for a semiconductor device book that carries diode and transistor theory beyond an introductory level and yet has space to touch on a wider range of semiconductor device principles and applications Such topics are covered in specialized monographs numbering many hundreds but the

voluminous nature of this literature limits access for students This book is the outcome of attempts to develop a broad course on devices and integrated electronics for university students at about senior year level The educational prerequisites are an introductory course in semiconductor junction and transistor concepts and a course on analog and digital circuits that has introduced the concepts of rectification amplification oscillators modulation and logic and Switching circuits The book should also be of value to professional engineers and physicists because of both the information included and the detailed guide to the literature given by the references The aim has been to bring some measure of order into the subject area examined and to provide a basic structure from which teachers may develop themes that are of most interest to students and themselves Semiconductor devices and integrated circuits are reviewed and fundamental factors that control power levels frequency speed size and cost are discussed The text also briefly mentions how devices are used and presents circuits and comments on representative applications Thus the book seeks a balance between the extremes of device physics and circuit design

Copper-based Ternary Oxide Semiconductor for Solar Energy Conversion and Environmental

Remediation Mohammad Kabir Hossain, 2019 **Solar Energy Conversion and Storage** Suresh C. Ameta, Rakshit

Ameta, 2015-11-05 Solar Energy Conversion and Storage Photochemical Modes showcases the latest advances in solar cell technology while offering valuable insight into the future of solar energy conversion and storage Focusing on photochemical methods of converting and or storing light energy in the form of electrical or chemical energy the book Describes various t

Nanocomposites N. B. Singh, 2022-12-22 Nanocomposites are composite materials that have dimensions less than 100 nm in at least one of their phases offering a higher surface to volume ratio They are high performance materials exhibit unusual properties and are considered as materials of the 21st century In this book experts from the field discuss the basic concepts synthesis characterization properties and applications of nanocomposites The book is helpful for researchers professional engineers students and those associated with a variety of disciplines of both academia and industry in seeking an understanding of what has been recently done in the field and the challenges related to it

Solar Hydrogen Production

Francesco Calise, Massimo Dentice D'Accadia, Massimo Santarelli, Andrea Lanzini, Domenico Ferrero, 2019-08-15 Solar Hydrogen Production Processes Systems and Technologies presents the most recent developments in solar driven hydrogen generation methods The book covers different hydrogen production routes from renewable sources to solar harvesting technologies Sections focus on solar energy presenting the main thermal and electrical technologies suitable for possible integration into solar based hydrogen production systems and present a thorough examination of solar hydrogen technologies ranging from solar driven water electrolysis and solar thermal methods to photocatalytic and biological processes All hydrogen based technologies are covered including data regarding the state of the art of each process in terms of costs efficiency measured parameters experimental analyses and demonstration projects In the last part of the book the role of hydrogen in the integration of renewable sources in electric grids transportation sector and end user applications is

assessed considering their current status and future perspectives The book includes performance data tables models and references to available standards It is thus a key resource for engineering researchers and scientists in both academic and industrial contexts involved in designing planning and developing solar hydrogen systems Offers a comprehensive overview of conventional and advanced solar hydrogen technologies including simulation models cost figures R D projects demonstration projects test standards and safety and handling issues Encompasses in a single volume information on solar energy and hydrogen systems Includes detailed economic data on each technology for feasibility assessment of different systems Eco- and Renewable Energy Materials Yong Zhou,2015-08-15 Eco and Renewable Energy Materials provides a survey of the current topics and the major developmental trends in the rapidly growing research area of clean energy materials This book covers but is not limited to photochemical materials fuels from light fuel cells electricity from fuels batteries electricity storage and hydrogen production and storage This book is intended as a vehicle for the dissemination of research results on energy based material science in the form of commissioned reviews and commentaries This book is for scientists and engineers interested in energy related materials compounds and electronic devices Prof Yong Zhou is currently serving as a full professor at the Eco Materials and Renewable Energy Research Center ERERC Nanjing University China

Advances in Composite Materials for Medicine and Nanotechnology Brahim Attaf,2011-04-01 Due to their good mechanical characteristics in terms of stiffness and strength coupled with mass saving advantage and other attractive physico chemical properties composite materials are successfully used in medicine and nanotechnology fields To this end the chapters composing the book have been divided into the following sections medicine dental and pharmaceutical applications nanocomposites for energy efficiency characterization and fabrication all of which provide an invaluable overview of this fascinating subject area The book presents in addition some studies carried out in orthopedic and stomatological applications and others aiming to design and produce new devices using the latest advances in nanotechnology This wide variety of theoretical numerical and experimental results can help specialists involved in these disciplines to enhance competitiveness and innovation **ERDA Energy Research Abstracts** United States. Energy Research and Development Administration,1977

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