Introduction To Photocatalysis From Basic Science To Applications

This book gives a comprehensive treatment of photocatalysis, a topic of increasing importance due to its essential role in many of todays environmental and energy-source problems. The first part presents a brief introduction to the principles and fundamental aspects of photocatalysis including photoelectric chemical semiconductors. Part II describes applications to environmental cleaning, such as water purification and cleaning of the atmosphere. Part III discusses applications to photoenergy conversion, for example water decomposition with TiO2, semiconductors and metal complexes. Serving as a timely and convenient reference source including exciting new advances, the book will appeal to academic and industrial researchers as well graduate and advanced undergraduate students.

Photocatalysis is a reaction which is accelerated by light while a heterogeneous reaction consists of two phases (a solid and a liquid for example). Heterogeneous Photocatalysis is a fast developing science which to date has not been fully detailed in a monograph. This title discusses the basic principles of heterogeneous photocatalysis and describes the bulk and surface properties of semiconductors. Applications of various types of photoreactions are described and the problems related to the modeling and design of photoreactors are covered.

This unique thesis discusses the development of conceptually novel and synthetically valuable methods that use visible light photocatalysis. Each chapter addresses a different topic in the emerging field of photocatalysis, which has become an indispensable tool for organic synthesis. Photocatalysis employs environmentally harmless and abundant visible light in the presence of a photosensitizer, and as such offers an attractive alternative to harmful UV light in photo-mediated reactions. This book introduces the novel concept of merging gold catalysis with visible light photocatalysis in a dual catalytic fashion, which demonstrates their compatibility with each other for first time and has inspired the development of various reactions. Moreover, a novel trifluoromethylation method, which combines radical addition chemistry with a polar rearrangement to synthesize valuable fluorinated compounds, is presented, since compounds featuring fluorinated functionality are the subject of increasing attention in pharmaceutical, agrochemical and material research. It also develops an external photocatalyst-free photochemical method for the synthesis of valuable indolizine heterocycles, where the product mediates its own formation. Lastly, it describes the synthesis and characterization of two novel highly porous metal-organic frameworks (MOFs). The comprehensive text is rounded out with illustrations and color figures.

This book is a printed edition of the Special Issue "Photon-involving Purification of Water and Air" that was published in Molecules

New and Future Developments in Catalysis is a package of seven books that compile the latest ideas concerning alternate and renewable energy sources and the role that catalysis plays in converting new renewable feedstock into biofuels and biochemicals. Both homogeneous and heterogeneous catalysts and catalytic processes will be discussed in a unified and comprehensive approach. There will be extensive cross-referencing within all volumes. The various sources of environmental pollution are the theme of this volume. The volume lists all current environmentally friendly catalytic chemical processes used for environmental remediation and critically compares their economic viability.

Offers in-depth coverage of all catalytic topics of current interest and outlines future challenges and research areas A clear and visual description of all parameters and conditions, enabling the reader to draw conclusions for a particular case Outlines the catalytic processes applicable to energy generation and design of green processes

Explains principles of solar energy semiconductor photocatalysis and systematically introduces both traditional and novel photocatalysts, including metal oxide/hydroxide photocatalysts, metal sulfide photocatalysts, and organic and plasmonic photocatalysts. The authors also demonstrate the composition and modification of photocatalysts via examples. It is well suited for laboratory researchers and industrial professionals.

The book explains the principles and fundamentals of photocatalysis and highlights the current developments and future potential of the green-chemistry-oriented applications of various inorganic, organic, and hybrid photocatalysts. The book consists of eleven chapters, including the principles and fundamentals of heterogeneous photocatalysis; the mechanisms and dynamics of surface photocatalysis; research on TiO2-based composites with unique nanostructures; the latest developments and advances in exploiting photocatalyst alternatives to TiO2; and photocatalytic materials for applications other than the traditional degradation of pollutants, such as carbon dioxide reduction, water oxidation, a complete spectrum of selective organic transformations and water splitting by photocatalytic reduction. In addition, heterogeneized polyoxometalate materials for photocatalytic purposes and the proper design of photocatalytic reactors and modeling of light are also discussed. This book appeals to a wide readership of the academic and industrial researchers and it can also be used in the classroom for undergraduate and graduate students focusing on heterogeneous photocatalysis, sustainable chemistry, energy conversion and storage, nanotechnology, chemical engineering, environmental protection, optoelectronics, sensors, and surface and interface science. Juan Carlos Colmenares is a Professor at the Institute of Physical Chemistry, Polish Academy of Sciences, Poland. Yi-Jun Xu is a Professor at the State Key Laboratory of Photocatalysis on Energy and Environment, College of Chemistry, Fuzhou University, China.

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the production of an array of chemical products is the theme of this volume. Photocatalysis is a topic of increasing importance due to its essential role in many of today's environmental and energy source problems. The use of solar energy for catalytic reactions results in a carbon dioxide–neutral process. All photocatalytic processes and the future developments in this area are discussed, including an economic analysis of the various processes. Offers in-depth coverage of all catalytic topics of current interest and outlines future challenges and research areas A clear and visual description of all parameters and conditions, enabling the reader to draw conclusions for a particular case Outlines the catalytic processes applicable to energy generation and design of green processes

Heterogeneous photocatalysis is a novel technique for water purification. Publications on photocatalysis span a relatively recent period of not more than 25 years. This is a technique that, according to our extensive experience on the development of laboratory scale and pilot plant units, has great promise to eliminate water and air pollutants. Photocatalysis offers much more than competitive techniques where pollutants are transferred from phases; photocatalysis can achieve complete mineralization of pollutants leaving non-toxic species such as CO2 and H2O and can be exploited at close to room temperature and ambient pressure.

This book details the chemistry of visible light-induced photocatalysis using different classes of nanocomposites. Starting with a general introduction and explanation of basic principles and mechanisms of (visible) light-induced photocatalysis in the first two chapters (not omitting a plaidoyer for furthering research and development in this promising field), the following chapters detail the different types and classes of nanocomposites currently used in light-induced photocatalytic applications, including e.g. metal and mixed metal-oxide nanoparticles and –composites, nanoporous materials, polymeric and carbon-based nanocomposites. They explain the characteristics and importance of the different types of nanocomposites, as well as their synthesis and fabrication.In the end of the book an outlook on the unique applications of novel nanocomposites is offered, for example in water treatment and disinfection and removal of pollutants from wastewater, self-cleaning window panes based on photoactive materials, and many more. The book also addresses the challenges in present photocatalytic research, and therefore is a must-read for everybody interested in the developing field of nanocomposites and visible light-induced photocatalysis.

Semiconductor photocatalysis has been considered a potentially promising approach for renewable energy and environmental remediation with abundant solar light. However, the currently available semiconductor materials are generally limited by either the harvesting of solar energy or insufficient charge separation ability. To overcome the serious drawbacks of narrow light-response range and low efficiency in most photocatalysts, many strategies have been developed in the past decades. This article reviews the recent advancements of visible-light-driven photocatalysts and attempts to provide a comprehensive update of some strategies to improve the efficiency, such as doping, coupling with graphene, precipitating with metal particles, crystal growth design, and heterostructuring. A brief introduction to photocatalysts is given first, followed by an explanation of the basic rules and mechanisms of photocatalysts. This chapter focuses on recent progress in exploring new strategies to design TiO2-based photocatalysts that aim to extend the light absorption of TiO2 from UV wavelengths into the visible region. Subsequently, some strategies are also used to endow visible-light-driven Ag3PO4 with high activity in photocatalytic reactions. Next, a novel approach, using long afterglow phosphor, has been used to associate a fluorescence-emitting support to continue the photocatalytic reaction after turning off the light. The last section proposes some challenges to design high efficiency of photocatalytic systems.

Combining basic concepts with the synthesis of new catalysts, reactor and reaction engineering, this book is a comprehensive resource for researchers.

Photocatalysis is a hot topic because it is an environmentally friendly approach toward the conversion of light energy into chemical energy at mild reaction environments. Also, it is well applied in several major areas such as water splitting, bacterial inactivation, and pollutants elimination, which is a possible solution to energy shortage and environmental issues. The fundamental knowledge and the frontier research progress in typical photocatalytic materials, such as TiO2-based and non-TiO2-based photocatalysts, are included in this book. Methods to improve the photocatalytic efficiency and to provide a hint for the rational design of the new photocatalysts are covered.

Introduction to PhotocatalysisFrom Basic Science to ApplicationsRoyal Society of Chemistry

Todays chemical industry processes worldwide largely depend on catalytic reactions and the desirable future evolution of this industry toward more selective products, more environmentally friendly products, more energy-efficient processes, a smaller use of hazardous reagents, and a better use of raw materials also largely involves the development of better catalysts and, specifically, purposely designed catalytic materials. The careful study and development of the new-generation catalysts involve relatively large groups of specialists in universities, research centers, and industries, joining forces from different scientific and technical disciplines. This book has put together recent, state-of-the-art topics on current trends in catalytic materials and consists of 16 chapters.

This critical volume examines the different methods used for the synthesis of a great number of photocatalysts, including TiO2, ZnO and other modified semiconductors, as well as characterization techniques used for determining the optical, structural and morphological properties of the semiconducting materials. Additionally, the authors discuss photoelectrochemical methods for determining the light activity of the photocatalytic semiconductors by means of measurement of properties such as band gap energy, flat band potential and kinetics of hole and electron transfer. Photocatalytic Semiconductors: Synthesis, Characterization and Environmental Applications provide an overview of the semiconductor materials from first- to third-generation photocatalysts and their applications in wastewater treatment and water disinfection. The book further presents economic and toxicological aspects in the production and application of photocatalytic materials.

Visible light is an abundant source of energy. While the conversion of light energy into electrical energy (photovoltaics) is highly developed and commercialized, the use of visible light in chemical synthesis is far less explored. Chemical photocatalysts that mimic principles of biological photosynthesis utilize visible light to drive endothermic or kinetically hindered reactions. Focusing on the basic principles of semiconductor photocatalysis, this book also gives a brief introduction to photochemistry, photoelectrochemistry, and homogeneous photocatalysis. In addition, the author - one of the leading authorities in the field - presents important environmental and practical aspects. A valuable, one-stop source for all chemists, material scientists, and physicists working in this area, as well as novice researchers entering semiconductor photocatalysis.

Nanotechnology and Photocatalysis for Environmental Applications focuses on nanostructured control, synthesis methods, activity enhancement strategies, environmental applications, and perspectives of semiconductor-based nanostructures. The book offers future guidelines for designing new semiconductor-based photocatalysts, with low cost and high efficiency, for a range of products aimed at environmental protection. The book covers the fundamentals of nanotechnology, the synthesis of nanotechnology, and the use of metal oxide, metal sulfide, and carbon-based nanomaterials in photocatalysis. The book also discusses the major challenges of using photocatalytic nanomaterials on a broad scale. The book then explores how photocatalytic nanomaterials and nanocomposites are being used for sustainable development applications, including environmental protection, pharmaceuticals, and air purification. The final chapter considers the recent advances in the field and outlines future perspectives on the technology. This is an important reference for materials scientists, chemical engineers, energy scientists, and anyone looking to understand more about the photocatalytic potential of nanomaterials, and their possible environmental applications. Explains why the properties of semiconductor-based nanomaterials make them particularly good for environmental applications Explores how photocatalytic nanomaterials and nanocomposites are being used for sustainable development applications, including environmental protection, pharmaceuticals, and air purification Discusses the major challenges of using photocatalytic nanomaterials on a broad scale

From environmental remediation to alternative fuels, this book explores the numerous important applications of photocatalysis. The book covers topics such as the photocatalytic processes in the treatment of water and air; the fundamentals of solar photocatalysis; the challenges involved in developing self-cleaning photocatalytic materials; photocatalytic hydrogen generation; photocatalysts in the synthesis of chemicals; and photocatalysis in food packaging and biomedical and medical applications. The book also critically discusses concepts for the future of photocatalysis, providing a fascinating insight for researchers. Together with Photocatalysis: Fundamentals and Perspectives, these volumes provide a complete overview to photocatalysis.

Provides a comprehensive overview of the emerging applications of ferroelectric materials in energy harvesting and storage Conventional ferroelectric materials are normally used in sensors and actuators, memory devices, and field effect transistors, etc. Recent progress in this area showed that ferroelectric materials can harvest energy from multiple sources including mechanical energy, thermal fluctuations, and light. This book gives a complete summary of the novel energy-related applications of ferroelectric materials?and reviews both the recent advances as well as the future perspectives in this field. Beginning with the fundamentals of ferroelectric materials, Ferroelectric Materials for Energy Applications offers in-depth chapter coverage of: piezoelectric energy generation; ferroelectric photovoltaics; organic-inorganic hybrid perovskites for solar energy conversion; ferroelectric ceramics and thin films in electric energy storage; ferroelectric polymer composites in electric energy storage; pyroelectric energy harvesting; ferroelectrics in electrocaloric cooling; ferroelectric in photocatalysis; and first-principles calculations on ferroelectrics for energy applications. -Covers a highly application-oriented subject with great potential for energy conversion and storage applications. -Focused toward a large, interdisciplinary group consisting of material scientists, solid state physicists, engineering scientists, and industrial researchers -Edited by the "father of integrated ferroelectrics" Ferroelectric Materials for Energy Applications is an excellent book for researchers working on ferroelectric materials and energy materials, as well as engineers looking to broaden their view of the field.

Nanostructured Photocatalysts: From Fundamental to Practical Applications offers a good opportunity for academic, industrial researchers and engineers to gain insights on the fundamental principles and updated knowledge on the engineering aspects and various practical applications of photocatalysis. This book comprehensively and systematically reviews photocatalytic fundamental aspects, ranging from reaction mechanism, kinetic modeling, nanocatalyst synthesis and design, essential material characterization using advanced techniques, and novel reactor design and scale-up. Future perspectives, techno-economical evaluation and lifecycle assessment of photocatalytic processes are also provided. Finally, a wide range of practical, important and emerging photocatalytic applications, namely wastewater treatment, air pollution remediation, renewable and green energy generation, and vital chemical production are thoroughly covered, making this book useful and beneficial for engineers, scientists, academic researchers, undergraduates and postgraduates. Provides a fundamental understanding of photocatalysis Covers all aspects of recent developments in photocatalytic processes and photocatalytic materials Focuses on advanced photocatalytic applications and future research advancements on energy, environment, biomedical, and other specialty fields Contains contributions from leading international experts in photocatalysis Presents a valuable reference for academic and industrial researchers, scientists and engineers

This book is a concise and up-to-date introduction to the topic of photocatalysis. It covers the fundamentals of photocatalysis, design of photoreactors and modelling and simulations for photoreaction. Also, industrial applications such as hydrogen production, water disinfection, degradation of air pollutants, pesticides and pharmaceuticals are described.

Photocatalysis, reactions carried out in the presence of a semiconductor and light, is rapidly becoming one of the most active areas of chemical research, with applications in areas such as electrochemistry, medicine, and environmental chemistry, Photocatalysis: Principles and Applications stresses the development of various types of photocatalytic semiconductors, including binary, ternary, quaternary, and composite, and their modifications by metallization, sensitization, and doping to enhance their photocatalytic activities. In addition to describing the principles and mechanisms of photocatalysis, it also discusses other possible applications of photocatalysis such as use as antifouling agents, controlling air pollution by degrading contaminants present in the environment, self-cleaning of glasses and tiles in the presence of light/artificial light, green composites, wastewater treatment, hydrogen generation, and inactivation of microorganisms. The book also describes medical applications and summarizes efforts in the field of photosplitting of water as a newer energy source and photoreduction of carbon dioxide for providing synthetic fuels and also a step towards mimicking photosynthesis. Introduces the basic principle of photocatalysis. Provides an overview of the types of semiconductors, their immobilization, and modifications to make them more active. Gives possible applications of photocatalysis in wastewater treatment and strategy to combat against different kinds of pollutions like water, air,

and soil. Summarizes efforts in the field of photosplitting of water as a newer energy source and photoreduction of carbon dioxide for providing synthetic fuels and as a step towards mimicking photosynthesis. Discusses inactivation of different kinds of microorganisms. Covers medical applications. Features Introduces the basic principle of photocatalysis. Provides an overview of the types of semiconductors, their immobilization, and modifications to make them more active. Gives possible applications of photocatalysis in wastewater treatment and strategy to combat against different kinds of pollutions like water, air, and soil. Summarizes efforts in the field of photosplitting of water as a newer energy source and photoreduction of carbon dioxide for providing synthetic fuels and as a step towards mimicking photosynthesis. Discusses inactivation of different kinds of microorganisms. Covers medical applications.

In Heterogeneous Nanocomposite-Photocatalysis for Water Purification, the authors introduce various heterogeneous photocatalysts based on novel nanostructures of metal oxide semiconductors and graphene used for water purification, including TiO2, Fe2O3, SnO2, WO3 and g-C3N4, and outlines their advantages and drawbacks. The nanocomposite-photocatalysts ZnO and CdS are compared with reduced graphene oxide (rGO), a rapidly growing materials system. The authors describe how the photocatalytic activity of known nanomaterials can be improved by modifying the structural and optical properties (i.e., phase composition). Introductory portion of the book includes a brief survey of all different kinds of heterogeneous photocatalysts Discusses the possible photocatalysis mechanism occurring during the degradation of different toxic pollutants Provides the photoelectrochemical measurement for synthesized catalysts, supporting the effective transportation of photoelectrons resulting into better catalytic properties

This book underscores the essential principles of photocatalysis and provides an update on its scientific foundations, research advances, and current opinions, and interpretations. It consists of an introduction to the concepts that form the backbone of photocatalysis, from the principles of solid-state chemistry and physics to the role of reactive oxidizing species. Having recognised the organic link with chemical kinetics, part of the book describes kinetic concepts as they apply to photocatalysis. The dependence of rate on the reaction conditions and parameters is detailed, the retrospective and prospective aspects of the mechanism of photocatalysis are highlighted, and the adsorption models, photocatalytic rate expressions, and kinetic disguises are examined. This book also discusses the structure, property, and activity relationship of prototypical semiconductor photocatalysts and reviews how to extend their spectral absorption to the visible region to enable the effective use of visible solar spectrum. Lastly, it presents strategies for deriving substantially improved photoactivity from semiconductor materials to support the latest applications and potential trends.

This book "Concepts of Semiconductor Photocatalysis" contains recent research on the preparation, characterization, and potential applications of the semiconductor photocatalyst. This research is promising and has received a lot of interest in the last few decades. The book covers advanced topics on the optical, physical, structural, and electro-catalysis and photo-catalysis applications. Development of new and noble efficient technology is pointing researchers toward the safe, facile, non-toxic, eco-friendly route of synthesis-to-applications, which can be used for manufacture at a large scale. This book presents an overview of the current photocatalyst fundamental theory, substantial applications, and use of the research worldwide. It is an important book for research organizations, government research-centers, academic libraries, and R

Chalcogenide-Based Nanomaterials as Photocatalysts deals with the different types of chalcogenide-based photocatalytic reactions, covering the fundamental concepts of photocatalytic reactions involving chalcogenides for a range of energy and environmental applications. Sections focus on nanostructure control, synthesis methods, activity enhancement strategies, environmental applications, and perspectives of chalcogenide-based nanomaterials. The book offers guidelines for designing new chalcogenide-based nanoscale photocatalysts at low cost and high efficiency for efficient utilization of solar energy in the areas of energy production and environment remediation. Provides information on the development of novel chalcogenide-based nanomaterials Outlines the fundamentals of chalcogenides-based photocatalysis Includes techniques for heterogeneous catalysis based on chalcogenide-based nanomaterials

Materials Science in Photocatalysis provides a complete overview of the different semiconductor materials, from titania to third-generation photocatalysts, examining the increasing complexity and novelty of the materials science in photocatalytic materials. The book describes the most recommended synthesis procedure for each of them and the suitable characterization techniques for determining the optical, structural, morphological, and physical-chemical properties. The most suitable applications of the photocatalysts are described in detail, as well as their environmental applications for wastewater treatment, gaseous effluents depollution, water splitting, CO2 ?xation, selective organic synthesis, coupling reactions, and other selective transformations under both UV light and visible-light irradiation. This book offers a useful reference for a wide audience from students studying chemical engineering and materials chemistry to experienced researchers working on chemical engineering, materials science, materials engineering, environment engineering, nanotechnology, and green chemistry. • Includes a complete overview of the different semiconductor materials used as photocatalysts • Describes methods of preparation and characterization of photocatalysts and their applications • Examines new possibilities to prepare effective photocatalysts

Filling the need for a ready reference that reflects the vast developments in this field, this book presents everything from fundamentals, applications, various reaction types, and technical applications. Edited by rising stars in the scientific community, the text focuses solely on visible light photocatalysis in the context of organic chemistry. This primarily entails photo-induced electron transfer and energy transfer chemistry sensitized by polypyridyl complexes, yet also includes the use of organic dyes and heterogeneous catalysts. A valuable resource to the synthetic organic community, polymer and medicinal chemists, as well as industry professionals.

Multifunctional Photocatalytic Materials for Energy discusses recent developments in multifunctional photocatalytic materials, such as semiconductors, quantum dots, carbon nanotubes and graphene, with an emphasis on their novel properties and synthesis strategies and discussions of their fundamental principles and applicational achievements in

energy fields, for example, hydrogen generation from water splitting, CO2 reduction to hydrocarbon fuels, degradation of organic pollutions and solar cells. This book serves as a valuable reference book for researchers, but is also an instructive text for undergraduate and postgraduate students who want to learn about multifunctional photocatalytic materials to stimulate their interests in designing and creating advanced materials. Covers all aspects of recent developments in multifunctional photocatalytic materials Provides fundamental understanding of the structure, properties and energy applications of these materials Contains contributions from leading international experts in the field working in multidisciplinary subject areas Focuses on advanced applications and future research advancements, such as graphene-based nanomaterials and multi-hybrid nanocomposites Presents a valuable reference for researchers and students that stimulates interest in designing advanced materials for renewable energy resources

Metal Oxide-Based Photocatalysis: Fundamentals and Prospects for Application explains the principles and fundamentals of metal oxide-based photocatalysis and the requirements necessary for their use in photocatalysis. It also discusses preparation methods for photocatalysis, and the advantages, disadvantages and achievements of the most important metal oxides (TiO2, ZnO, Fe2O3, Ta2O3, CuO, NiO, Cr2O3, RuO2, etc.). The book concludes with the most important photocatalytic applications and an overview of the future. Applications are organized by potential needs and solutions, addressing such areas as water treatment, hydrogen production, air treatment, chemical synthesis, and applications in medicine and construction. Provides coverage of applications, presenting needs and solutions Covers essential applications, such as water treatment, hydrogen production, air depollution, medical applications, and much more Includes the characterization of the most important metal oxides used in heterogeneous photocatalysis

Surface Science of Photocatalysis, Volume 32, summarizes significant findings on the surface science behind various classic and novel photocatalysts for energy and environmental applications, with special emphasis on important surface/interface processes in photocatalysis, such as interfacial charge transfer, function of co-catalysts, and adsorption over photocatalyst surface. This book timely and systematically reviews the state-of-the-art of the surface science in semiconductor-based photocatalysis, serving as a useful reference book for both new and experienced researchers in this field. Provides timely reviews on cutting-edge research on surface science and photocatalysts Comprehensively discusses novel photocatalysts, such as metal oxides, metal sulphides, graphitic carbon nitrides, graphene and metal-organics Presents important surface/interface processes in photocatalysis, like Z-scheme system and surface heterojunctions Investigates the function of co-catalysts and the adsorption on photocatalyst surfaces Edited by world-leading researchers in interface science

This book describes the photocatalytic mechanism, factors affecting photocatalytic activity, design and preparation of different kinds of nanostructured photocatalysts, and their applications in the environmental and energy fields. Further, it illustrates a broad range of modification methods including ion-doping, heterojunction, noble metal deposition, morphological control and sensitizations, which are used to extend the light absorption range of photocatalysts and reduce recombination between electrons and holes. Promising applications include water splitting, contaminant decomposition and photocatalytic reduction of CO2, which are closely related to environmental redemption and new energy development. The book offers an intriguing and useful guide for a broad readership in various fields of catalysis, material sciences, environment and energy.

Presenting the basic science of semiconductor photocatalysis together with the various practical applications, this textbook is ideal for graduate students. It covers fundamental principles and applicable techniques of light, solid state physics, electrochemistry, reaction kinetics, and materials processing. A solid understanding of semiconductor photoelectrochemistry is developed through discussing the basic properties of a representative photocatalytic material, TiO2; the basic science of the light absorption phenomenon and the application to the powder suspension useful for the photocatalytic research; and the electronic state of semiconductors. Following this, the textbook moves on to explore photoelectrochemistry; the mechanism and kinetic analysis of photocatalytic reactions; typical fabrication methods of common photocatalysts and the factors for improving photocatalytic activity; and evaluation methods of photocatalytic activity. The textbook concludes by looking at the future prospects of the applications of photocatalysis. This introductory textbook provides a foundation in photocatalysis to supplement graduate courses in catalysis, environmental science, materials science and chemical engineering.

Photocatalysis: Fundamental Processes and Applications, Volume 32 in the Interface Science and Technology Series, discusses the fundamental aspects of photocatalysis and its process and applications to the decontamination of wastewater, hydrogen production via water splitting, and photo reduction of carbon dioxide to hydrocarbon. The book discusses the fundamental aspects of all applications together with their proper mechanisms, thus providing essential information for deep research in the area of clean environment and green energy production. Provides background on the fundamental and experimental processes of photocatalysis Covers photocatalysis and its impact on creating a clean environment and energy sources Applies photocatalysis to the decontamination of wastewater, hydrogen production via water splitting, and photo reduction of carbon dioxide to hydrocarbon Edited by a world-leading researcher in interface science

Nanostructured Materials for Visible Light Photocatalysis describes the various methods of synthesizing different classes of nanostructured materials that are used as photocatalysts for the degradation of organic hazardous dyes under visible light irradiation. The first three chapters include a general introduction, basic principles, mechanisms, and synthesis methods of nanomaterials for visible light photocatalysis. Recent advances in carbon, bismuth series, transition metal oxide and chalcogenides-based nanostructured materials for visible light photocatalysis are discussed. Later chapters describe the role of phosphides, nitrides, and rare earth-based nanostructured-based materials in visible light photocatalysis, as well as the characteristics, synthesis, and fabrication of photocatalysts. The role of doping, composites, defects, different facets, morphology of nanostructured materials and green technology for efficient dye removal under visible-light irradiation are also explored. Other topics covered include large-scale production of nanostructured materials, the challenges in present photocatalytic research, the future scope of nanostructured materials regarding environmental hazard remediation under visible light, and solar light harvesting. This book is a valuable reference to researchers and enables them to learn more about designing advanced nanostructured materials for wastewater treatment and visible-light irradiation. Covers all the recent developments of nanostructured photocatalytic materials Provides a clear overview of the mechanism of visible light photocatalysis and the controlled synthesis of nanostructured materials Assesses the major challenges of creating visible light photocatalysis systems at the nanoscale

Photocatalytic materials can improve the efficiency and sustainability of processes and offer novel ways to address issues across a wide range of fields—from sustainable chemistry and energy production to environmental remediation. Current Developments in Photocatalysis and Photocatalytic Materials provides an overview of the latest advances in this field, offering insight into the chemistry and activity of the latest generation of photocatalytic materials. After an introduction to photocatalysis and photocatalytic materials, this book goes on to outline a wide selection of photocatalytic materials, not only covering typical metal oxide photocatalysts such as TiO2 but also exploring newly developed organic semiconducting photocatalysts, such as g-C3N4. Drawing on the experience of an expert team of contributors,

Current Developments in Photocatalysis and Photocatalytic Materials highlights the new horizons of photocatalysis, in which photocatalytic materials will come to play an important role in our day-to-day lives. Reviews developments in both organic- and inorganic-based materials for use in photocatalysis Presents the fundamental chemistry and activity of a broad range of key photocatalytic materials, including both typical and novel materials Highlights the role photocatalytic materials can play in sustainable applications