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Book review

Photocatalysis: Science and Technology
M. Kaneko, I. Okura (Eds.); Springer, Heidelberg, ISBN 3-540-43473-9

Photocatalytic chemistry involving semiconductor materials has grown in the last decade from a subject of esoteric speciality interest to one of central importance in both academic and technological research. In this context, environmental pollution and its control through non-toxic treatment and easy recovery processes is a matter of serious concern. Fossil fuels and the ever increasing problem of carbon dioxide concentrations is one particular issue that is constantly in the public eye and world press media.

The book commemorates the 20th Symposium of the Solar Energy Research Group of the RIKEN Institute and Catalyst Society of Japan. This being said, it is not a series of presented lectures but in fact a compilation of contributions within each chapter from different Japanese experts covering both the fundamental and research issues of photocatalysis. The book begins with a brief overview of the importance of the field of photocatalysis and its attention-seeking areas. The fundamentals of photoelectrochemical processes are reviewed in the second chapter for semiconductor devices. Here the theory and development of electrodes for solar-energy conversion and carbon dioxide reduction are discussed. Remaining on the fundamental side, the third chapter deals with the design, preparation and characterisation of highly active metal oxide photocatalysts with much of the discussion concentrating on the manufacturing and laboratory methods for titania pigments. The fundamental processes at semiconductor/liquid interfaces are covered in Chapter 4 with particular emphasis on the types and nature of surfaces. Such fundamental processes are also covered in Chapter 5 for microparticulates, while in Chapter 6 new approaches in the solution-phase processing of semiconductors is covered, especially related to deposition methodologies. Application processes for cleaning are dealt with in Chapters 7–10. Here, the self-cleaning properties of titania pigments is discussed in Chapter 7, with Chapter 8 covering atmospheric contaminants. Water-treatment processes and their design and efficacy are discussed in Chapter 9, while Chapter 10 covers second-generation titania pigments for visible-light sensitisation. The final and very large Section III in the book deals with applications in terms of photoenergy conversion processes. A series of 10 chapters deals with this area. Organic photoreactions are covered in Chapter 11, with Chapter 12 examining sonophotocatalysis. Gas-phase photolysis is specific to sodium hydroxide coated photocatalysts in Chapter 13 while water photolysis and splitting using sodium carbonate solutions is dealt within Chapter 14. Chapter 15 examines the efficiency of tunnel structured titanates for water photolysis whereas Chapter 16 covers layered structures. Artificial photosynthesis of water splitting using quinone redox couples is dealt within Chapter 17, with Chapter 18 covering metal complexes such as viologens. Future reactions in photosynthesis are proposed in Chapter 19 and solar titanium dioxide cells in Chapter 20, with emphasis on dye-sensitisation and electron-transfer processes.

In total, the chapters are each well referenced, superbly illustrated and grammatically acceptable. In conclusion, whilst the book is an edited text, it nevertheless provides a most valuable source for focusing a number of the most important academic and industrial areas of development in photocatalysis that will inevitably provide significant advances for the future of mankind. It makes interesting reading and provides a valuable reference source for chemists, physicists and biologists working in the field in both academia and industry alike.

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