On Solar Hydrogen & Nanotechnology

The multi-author book *On Solar Hydrogen & Nanotechnology*, edited by Lionel Vayssieres, seeks to highlight recent research results on the photoelectrochemical production of hydrogen in combination with nanotechnological approaches. I am sure that the authors spark a lot of interest by marrying two highly topical and innovative fields of science. However, there remains the question of whether this volume goes beyond serving current trends.

The book is divided into five parts, which are entitled "Fundamentals, Modeling, and Experimental Investigation of Photocatalytic Reactions for Direct Solar Hydrogen Generation", "Electronic Structure, Energetics and Transport Dynamics of Photocatalyst Nanostructures", "Development of Advanced Nanostructures for Efficient Solar Hydrogen Production from Classical Large Bandgap Semiconductors", "New Design and Approaches to Bandgap Profiling and Visible-light-active Nanostructures", and "New Devices for Solar Thermal Hydrogen Generation". Thus, the collection covers fundamental aspects, the synthesis and characterization of new nanomaterials, the important topic of visible-light-driven splitting of water (6 chapters), and finally solar thermal hydrogen production.

The first part of the book contains an introductory chapter by Eric Miller and three contributions about photocatalysis on TiO_2 surfaces. Two chapters on modeling of these reactions are complemented by one on a high-resolution scanning tunneling microscopy study of oxygen and hydrogen adatoms on a rutile(110) surface. Since TiO_2 is the most important photocatalyst, it is an obvious choice to start the volume with articles on this material. Spectroscopy is an important tool to elucidate the electronic structure of materials. Part 2 is mainly devoted to X-ray, UV/Vis, and infrared spectroscopic studies of different photocatalysts. Chapter 9 is concerned with the comprehensive characterization of a specific system: quantum-dot-sensitized TiO_2 photocathodes.

The first two parts of Vayssieres's book deal with general and fundamental issues of photocatalytic water splitting. Part 3 brings in the specific bias towards nanotechnology. The four chapters of this part describe the synthesis and characterization of nanostructured TiO_2, ZnO, WO_3, and Fe_2O_3 photoelectrodes. From my perspective, Part 4 was the most exciting to read, as it contains chapters on non-classical approaches and attempts to find photocatalysts for the visible region of the spectrum. This includes a chapter on high-throughput screening of photocatalysts, two on the synthesis of new nanostructured materials (classical photocatalysts and quantum-dot-sensitized systems), one on doped photocatalysts, and one on supramolecular photocatalysts. The book concludes with two chapters on recent developments in solar thermal splitting of water.

In conclusion, I think that the book will be interesting for scientists and students of neighboring fields who like to expand their knowledge, or for "beginners" (e.g., new PhD students) to obtain an overview of the state of the art. Since this volume contains a collection of chapters on very specific and advanced research results, it is not suitable as a textbook for undergraduate students. In answer to my question at the start of this review, I find that this work contains solid in-depth science, and goes far beyond "trendy" issues. I can recommend this collection to interested readers.

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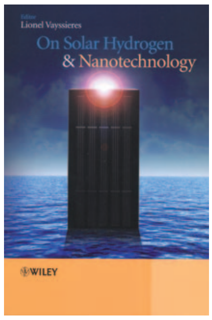

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