

Book Review

Light Harvesting NanoMaterials, Bentham e-Books, ISBN: 978-1-60805-959-1; e-ISBN: 978-1-60805-958-4

Edited by Surya Prakash Singh

Light Harvesting NanoMaterials, Bentham e-Books, ISBN: 978-1-60805-959-1; e-ISBN: 978-1-60805-958-4 Edited by Surya Prakash Singh The harvesting, capture and efficient conversion of solar light energy into electrical and heat energy through chemical and structural materials is now a rapid and exciting field of significant advancement and investigation in the scientific world. Many of these novel and often complex materials can attain important developments for many industrial outlets in energy transformation from solar power. This book targets a number of key newly developed nano-materials and consists in total of five chapters each one compiled by authors who are experts in that particular field and is edited by Surya Prakash Singh. The book consists of a number of important topics many developmental in the fields of organic/polymeric nano-materials which brings the reader up-to-date on many important features. The first chapter covers recent investigations covering the inter-locking and embedding of inorganic transition metal compound based nano-particles onto solar panel surfaces as anti-reflective coatings in order to enhance light absorption characteristics for effective energy conversion. Silicon, titanium and silver compounds in various nano-formats are highlighted. Here the properties of the particles in harvesting light energy as a support and their photochemistry provides many important answers to questions in relation to the efficiencies of energy harnessing.

The efficiencies of these processes is examined practically and theoretically in some depth with many very well illustrated devices. Silver nano-particles were particularly valuable and effective in this regard for enhancing solar energy absorption. Nano-crystalline titanium dioxide is a widely investigated material for solar energy harnessing but its inefficiency in absorption like many materials is a major deficiency. In chapter two, the use of doped titanias utilising tetrapyrrolic sensitizers and various metal complexes for overcoming this problem is reviewed. Here, the deficiencies of usual ruthenium complexes is superseded via more effective porphyrins, phthalocyanines and corroles and with enhanced coupling i.e. via zinc significant energy conversions may be achieved. The next chapter explores the behavior and properties of polymeric materials as matrices for nano-composites where again energy efficiency conversion is crucial in determining the

role of the light induced physic-chemical processes. In this case the design of polymer based nanocomposites is widely assessed and is proving to be one of the most interesting and upcoming fields in solar energy harnessing. Of course, one major setback in this area with organo-materials is durability. In chapter four, one rather interesting area of growing interest in utilising solar energy is that dealing with gold and titania nanoparticles called "plasmonic photocatalysts". This important field has direct relevance to photo-induced electrical and semiconductor processes as well as significance in the manufacture of photoelectrochemical catalysts due to their broad visible absorption characteristics and hence high efficiency. In this context, the formulation and properties of the various catalysts can result in the production of novel highly active material complexes with high efficacy for oxidation of organic compounds. In the last chapter C60-based solar cells with copper oxides, CuInS₂, phthalocyanines, diamond, porphyrin and exciton-diffusion blocking layers have been fabricated and characterized for use in energy efficient solar cell construction. High efficiencies are observed in all these devices when utilized with C60.

To summarize, this important edited text provides the reader with a highly useful and valuable source of scientific information which focuses on many important aspects of development in light energy harvesting processes in both fields of photochemistry and photophysics thus providing many valuable ways forward for further scientific development for the future in solar energy conversion and photocatalysis. It makes interesting reading coupled with many new ideas and is very well illustrated and certainly provides a valuable reference source for chemists, physicists, biologists and engineers working in the field in both academia, government and industry, alike.

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