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Preface

Energy and environmental issues are of great concerns for the public and will keep increasing in the next few decades. The demand for clean energy sources in our current society also increases with large-scale economic developments and population growth. It is crucial to build clean energy systems in order to solve both the environmental issues and the energy demands. Alternative energy sources to replace fossil and mineral-based fuels have been actively searched for to meet the clean energy demands. Among the renewable energy sources defined as clean energy from natural sources, such as solar, rain, tides, wind, waves, biomass, and geothermal heat, solar energy is one of the greatest sources of renewable energy for meeting the above demands.

Along with developments of related solar technologies, storage of this energy as chemical energy in the form of hydrogen is a promising method to add to the solar cell technology, due to its sporadic nature. At present, solar hydrogen production from water has been achieved by the following several methods:

(1) electrolysis of water using a solar cell
(2) reforming of biomass
(3) photocatalytic or photoelectrochemical water splitting.

Photocatalytic water splitting is an artificial photosynthesis technique and contributes to a definitive green sustainable chemistry to solve energy and environmental issues.

This book, entitled *Green Photo-active Nanomaterials: Sustainable Energy and Environmental Remediation*, is an advanced book about the fundamentals of solar energy conversion, natural and artificial photosynthetic systems, nanotechnology and nanoscience, and the application of

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Edited by Nurxat Nuraje, Ramazan Asmatulu and Guido Mul
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nanoscience and nanotechnology in energy and environmental remediation, as well as educational and training purposes. Furthermore, nanotechnology has a great potential to design artificial photosynthesis systems to store solar energy, produce fuels from biomass, reduce organic contaminants from the environment, and convert carbon dioxide to useful hydrocarbon fuels because of the outstanding mechanical, electrical (conductive and semiconductive), optical, magnetic, quantum mechanics, and thermal properties of nanomaterials. These unique properties of nanoscale materials, such as nanoparticles, nanotubes, nanowires, nanofibers, nanocomposites, nanopores, and nanofilms, allow them to design the next generation of photosynthetic devices in energy and environmental applications.

Recent publications in green photoactive nanostructured materials for energy and environment have shown that increased and sophisticated progress has been made using innovatively designed nanostructured materials in various devices. It is very important for us to provide an advanced book which can provide the basic science of nanomaterial and solar spectrum interactions, green synthesis of nanomaterials, and descriptions of natural photosynthetic systems which will inspire us to design more efficient photoelectrochemical devices. This book will detail recent developments in green photo-active nanostructures materials in water splitting, biomass, and environmental remediation. It also emphasizes the recent development of nanostructured materials for carbon dioxide conversion, degradation of pollutants in environment, and green chemistry. The book also discusses the safety and risk assessments of the nanostructured materials used for various energy production systems. Therefore, this book will be informative for researchers in photoactive nanomaterials in energy and environment application, and also will be an excellent text book for advanced study in the Universities from fundamental points of views.

Thus, the editors are very pleased to present the recent progress in photo-active nanomaterials in energy and environment remediation in the publication of this great book for engineers, scientists and other readers, policy makers, and scientific communities. We are also thankful for the authors' hard work and contributions, and reviewers' comments and suggestions. During the editing process, we also have received tremendous support from the editorial team of the RSC, including Dr. Merlin Fox and Dr. Mina Roussenova. We also specially thank Dr. Sindee Simon (Texas Tech) for her kind advice and support. We acknowledge all support from Texas Tech University, MIT, and Wichita State University. Without all the above support, it would not have been possible for us to publish this book.

Dr Nurxat Nuraje, Texas Tech University, USA
Dr Ramazan Asmatulu, Wichita State University, USA
Dr Guido Mul, University of Twente, The Netherlands