Preface

This Special Topic Volume is the results of the contribution of thirty four experts form the international scientific community in the respective field of research. It thoroughly covers newly developed photocatalytic materials, photocatalytic surface, photocatalytic reactors and their designs, for the environmental cleanup applications as well as for hydrogen generation and storage. It gives the latest and in-depth coverage to the physics, chemistry, nanomaterials, nano-composite, and engineering of photocatalytic materials applications for environmental applications.

Nowadays, environment pollution and energy crisis are faced throughout the world. So to overcome these problems it is an urgent task to develop technologies that can remove the pollution and can provide alternative clean energies. Photocatalysis is one of the promising methods for both the problems and becoming more and more attractive to industry today because global environmental pollution has come to recognized as a serious problem that need to be addressed immediately. "Photocatalysis" has potential to open one of the desirable technologies for environmental abatement and production of next generation's fuel. The photocatalysis is a phenomenon to promote chemical reactions on a surface of irradiated semiconductor. The essence of the photocatalysis is attributed to the property of photo-excited carriers (electrons and holes) with strong oxidization and reduction. That finally contributes to the decomposition, deodorization, and sterilization of the hazard organics, as well as decomposition of water to hydrogen and oxygen. The use of photocatalytic materials for the environmental cleanup and hydrogen production by water splitting was stated after a remarkable work published in ***Nature*** in 1972 and called Honda-Fujishima effect. A. Fujishima and K. Honda achieved ultraviolet light-induced water cleavage using titanium dioxide (TiO_2) photoanode in combination with platinum electrode soaked in an electrolyte aqueous solution. This opened up the possibility of photocatalytic degradation of organic pollutant and solar energy conversion. Intense research carried out over past few decades has resulted in improved environmental cleaning and hydrogen production using photocatalysts.

In order to reduce the environmental pollution and production of next generation fuel tremendous efforts are under progress and they are mainly based on photocatalytic processes, as they are highly cost effective and cheap as compared to other processes. But still to meet the global challenges, there is need to focus on development of novel photocatalytic materials and surfaces for these applications. Presently, many researchers are working on development of new photocatalytic materials, surfaces to meet the pollution problem. Here in this volume development of visible light active photocatalytic materials and surface have been covered some extent.

This volume is indeed the result of remarkable cooperation of many distinguished experts, who came together to contribute their research work and comprehensive, in-depth and up to date review chapters. I am very thankful to all contributing authors who, in spite of their busy life in research and teaching, willingly accepted the call to contribute and sent their manuscript in time. I would also like to express my gratitude to all the publishers and authors and others for granting us the copyright permissions to use their illustrations. Although sincere efforts were made to obtain the copyright permissions from the

respective owners to include the citation with the reproduced materials, I would like to offer my sincere apologies to any copyright holder if unknowingly their right is being infringed.

This volume contains twelve state-of-the-art research articles and reviews: Chapter 1, a review article, focuses on the contribution of nanotechnology for removal of water pollutants and provides a critical analysis of various reports on the degradation of pollutants by TiO_2 nanotubular photocatalytic materials and surfaces.

Chapter 2, is also a review article focuses on the application of TiO_2 mainly for conversion of solar light in to electrical energy and water splitting for hydrogen production. Chapter 3 is research article focuses the modification of photocatalytic materials by doping with metal and study its properties for photocatalytic degradation of dye. Chapter 4, demonstrate the use of photocatalytic materials for development of auto-cleaning surface of buildings by addition of photocatalyst into cement. Chapter 5, 6, & 7 contains, the synthesis of nano-composite and modified metal ion doped photocatalyst for the degradation of dye pollutants in water in presence of visible and ultraviolet light. Chapter 8 & 9, talks about the photocatalytic thin film development by doping with diethanolamine (DEA), MCM-41 and silver for photocatalytic degradation of dye and for gaseous hazard air pollutants such as benzene, toluene, ethylbenzene and xylene (BTEX) under visible light. Chapter 10 & 11, are review article summarizes the remediation of amines and photocatalytic degradation of carboxylic acids from waste water. Chapter 12 is a review article based on the synthesis of photocatalysts and design of photoreactors for treatment of industrial effluents and also brings out inadequacies associated with the photocatalytic technology for wastewater treatment.

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Rajesh J. Tayade
Discipline of Inorganic Materials & Catalysis,
Central Salt & Marine Chemicals Research Institute,
Bhavnagar
India