TITANIUM DIOXIDE NANOMATERIALS

This special section of the Journal of Materials Research contains articles that were accepted in response to an invitation for manuscripts.

Introduction

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Titania (TiO_2) is one of the most commonly investigated semiconductor oxides. Inexpensive, innocuous, and environmentally-friendly, it is widely used as a pigment in sunscreens, paints, ointments, toothpaste, and catalysts.[1] Since Fujishima and Honda's discovery of the photoelectrocatalytic water splitting phenomenon on TiO_2 electrodes in 1972[2], the photocatalytic properties of TiO_2 has inspired great interest. In recent decades, the study of photocatalysis, photo-voltaic solar cells, and photoelectrochromic devices on TiO_2-based materials has received immense attention for mostly energy and environmental concerns. Consequently, the number of publications related to TiO_2 has increased exponentially.

This Focus Issue of the *Journal of Materials Research* provides a snapshot of current research on TiO_2 nanomaterials: from studies of the fundamental properties to a variety of applications. It covers nanoparticles, nanocrystals, nanowires, nanosheets, thin films, nanocomposites, doping, photocatalysis, electrocatalysis, dye-sensitized solar cells and memory devices. Review articles summarize the evolution of 1D nanostructures from pulsed chemical vapor deposition, nanotubes and its composites, crystallization behavior, phase stability and binding energy in pure and doped nanotubes. A large part of the original research is on the exploration of the various synthetic methods which underscores the importance and continuing interest in the synthesis of novel forms of TiO_2. Another significant portion of these papers explores the application of TiO_2 in photocatalytic hydrogen generation, dye-sensitized solar cells and photocatalytic pollution removal, demonstrating that renewable energy and concerns for a clean environment continue to play an important role in research agendas. The heterojunctions of anatase/rutile or anatase/brookite play important roles in the improvement of photocatalytic activity (Chen et al., Ma et al., Lü et al.), suggesting a possible new research trend in the modification of TiO_2. Also, worthy of special mention is its application as an electrocatalyst which shows high oxygen evolution activity (Huang et al.), and as a catalyst in PEM fuel cells (Philips et al.). We hope that this focus issue will inspire more research interest and discoveries on TiO_2 nanomaterials in the future.

The Guest Editors are indebted to the many authors and reviewers who have helped to make this Focus Issue of the highest quality.

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