Nature-Inspired Design of Nanostructured and Biomimetic Materials for Renewable Energy Applications

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Abstract

Nature can serve as inspiration for solving problems in many emerging fields including renewable energy, environmental remediation, and biotechnology. Mimicking nanotechnology found in Nature, we can create sophisticated light-harvesting assemblies, devise new methods for synthesizing fuels, and develop tools to synthesize novel functional materials. The main goals of this research are to explore new Nature-inspired and biomimetic functional nanomaterials, study their physical and chemical properties, and understand their "bottom-up" assembly into hierarchical nanostructured materials. Fundamentals revealed in the synthesis of these materials are then applied to solve problems in solar energy conversion, environmental remediation, and medicine. This presentation will focus on three main areas: (a) synthesis of nanomaterials based on a bottom-up paradigm including nanoclusters, nanowires, nanotubes, and thin films; (b) self-assembly of well-defined hierarchical nanoarchitectures of these materials to better understand and control the properties of self-assembled nanomaterials; and (c) applications of these materials for renewable energy and functional coatings including nanostructured solar cells, solar fuels, and antifogging.