

Title: Titania Nanostructures for Electrical Energy Production and Hydrogen Generation in Photoelectrochemical Cells

Type: Student

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Description: This proposal focuses on the development and characterization of ordered dye-sensitized titanium dioxide (TiO₂) nanostructures for photoelectrochemical applications related to areas of energy efficiency and renewable energy. More specifically, with our collaboration with PNNL, this project aims to further explore the development of ordered TiO₂ nanorod arrays and films, as well as nanocable or nanocomposite structures, with the purpose of continuously improving photoelectrochemical cell devices for more efficient electrical energy production and hydrogen generation at the nanoscale. Moreover, the proposed research emphasizes the enhancement of the fundamental understanding of the physical properties and performance of ordered nanostructured materials. Our research efforts are anticipated to (1) further develop and improve ordered dye-sensitized TiO₂ nanorods for both electrical and chemical energy generation in photoelectrochemical cells, (2) gain a better comprehensive understanding of the influences of ordered TiO₂ nanostructures on electron transport and ion diffusion processes, as well as internal transport resistance and (3) explore the use of other potential oxide nanomaterials for the development of nanostructures that can be utilized in other various applications in nanoscience and nanotechnology. As a result, through joint efforts between UW and PNNL, the proposed research will have a broad impact on nano-based science and technology for the advancement of energy efficiency and productivity, in addition to the direct impact on the progress of photoelectrochemical cell devices as an affordable means to achieving clean, regenerative energy.