

## **Electrocatalysis and Photoelectrochemistry Based on Functional Nanomaterials**

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**Abstract:** Catalysis plays a key role in chemical production, energy conversion and storage, air purification, water treatment, food processing, and the life sciences. In this talk, I will report briefly on the electrocatalytic activity of Pd, Au and Cu based nanomaterials and the catalysis of TiO<sub>2</sub> based nanostructured photocatalysts. Pd possesses several exceptional properties which enable its promising applications in hydrogen purification, storage, and detection. The significant role of Pd based nanomaterials in facilitating the growth of a hydrogen economy will be addressed. There is great interest in the conversion of carbon dioxide to useful chemicals and fuels toward addressing the increasingly serious impacts of global climate change. The design of high-performance Au and Cu based nanomaterials for the efficient electrochemical reduction of CO<sub>2</sub> will be discussed. TiO<sub>2</sub> is considered as one of the most promising photocatalysts due to its non-toxicity, high stability, and cost effectiveness. The primary drawback of TiO<sub>2</sub> is its large band gap energy; UV irradiation is a prerequisite for the initiation of its photochemical and photoelectrochemical processes. The modification of TiO<sub>2</sub> nanomaterials in the achievement of a visible light response will be presented. In addition, the application of functional nanomaterials in electrochemical sensing and biosensing will be highlighted.