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# Heterostructured TiO<sub>2</sub> nanotree arrays with silver quantum dots loading for enhanced photoelectrochemical properties

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**Keywords:** TiO<sub>2</sub> nanotree arrays; Heterostructure; Ag quantum dots; Morphology; Optical properties; Photoelectrochemical properties.

## ABSTRACT

Novel heterostructured titanium dioxide (TiO<sub>2</sub>) nanotree arrays (NTAs) were synthesized through a secondary hydrothermal process on a FTO substrate, and silver quantum dots (QDs) were loaded by a magnetron sputtering method for enhancing the photoelectrochemical (PEC) properties. The hierarchical TiO<sub>2</sub> NTAs composed of rutile phase nanorods (NRs) as trunks and anatase nanosheets as branches possess an enlarged specific surface area, which allows for enhanced QDs attaching. The hierarchical structure of the rutile/anatase junctions allows for a lower recombination rate of electron-hole (e-h) pairs and an accelerated electron transfer compared to TiO<sub>2</sub> NRs. After the decoration of Ag QDs, the absorption of light expanded to visible light range due to the surface plasmon resonance (SPR) of Ag QDs. The morphology, Raman spectral, optical properties, and PEC performance were investigated. The morphology is dendriform. The absorption edges of the samples show a slight red-shift and a SPR in the UV-vis absorption spectra. The SPR peaks range from 524 to 600 nm. The analysis of performance including linear voltammetry and transient photocurrent reveal that the photocurrent of Ag(15s)/TiO<sub>2</sub> NTAs is up to 140 times

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