

**TITANIUM / TITANIUM DIOXIDE SCHOTTKY JUNCTION AND HIGHLY PHOTOACTIVE ANTIMONY SULPHIDE PHOTOANODE FOR SOLAR WATER SPLITTING**

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Artificial photosynthesis has emerged as a promising solution for producing sustainable chemical fuels, including hydrogen, to address the energy and environmental challenges associated with non-renewable energy sources like fossil fuels. Among the various approaches, photoelectrochemical water splitting, mainly based on metal oxide semiconducting materials, has garnered significant attention. These materials offer suitable band gaps, flat band potentials, low electrical resistance, and excellent corrosion resistance in aqueous solutions, making them ideal for achieving efficient solar conversion efficiency. One such material of interest is Ti/TiO<sub>2</sub> nanotube arrays (TNTA) Schottky junction, which is synthesized through electrochemical anodization. This has captured considerable scientific interest due to their simplicity in synthesis, high electron mobility, and controllable dimensional parameters. By employing a facile electrochemical synthesis strategy on a porous Ti metal sheet, the TNTA Schottky junction is synthesized. To enhance its performance further, the concept of an n/n heterostructure is introduced by coating the TNTA photoanode with an n-type stibnite (Sb<sub>2</sub>S<sub>3</sub>) layer. Sb<sub>2</sub>S<sub>3</sub> is selected for its suitable band gap position and high visible light response. In this study, it was demonstrated that incorporating a thin layer of Sb<sub>2</sub>S<sub>3</sub> significantly enhances the photoelectrochemical response of the TNTA Schottky junction. The highest photoelectrochemical response of 2.81 mA cm<sup>-2</sup> was achieved for the TNTA/Sb<sub>2</sub>S<sub>3</sub> photoanode under AM 1.5 G illumination at 0.8 V vs. RHE in a 0.5 mol dm<sup>-3</sup> Na<sub>2</sub>SO<sub>3</sub> aqueous solution. Notably, this response is more than ten times greater than that observed for the bare TNTA photoanode. The improved performance has been attributed to several factors, including a lower recombination rate of photogenerated charge carriers, broadened spectral response, and enhanced charge transfer/transport occurring at the solid/liquid interfaces facilitated by the morphology of TiO<sub>2</sub> and incorporation of Sb<sub>2</sub>S<sub>3</sub>.

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