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Enhanced light harvesting and charge separation properties of the Ti/TiO2 - Sb2S3 Schottky junction for enhanced Photoelectrochemical performance

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Photoelectrochemical (PEC) water splitting is a promising candidate for solar energy conversion, generating a sustainable source of energy in the form of chemical bonds without greenhouse gas emissions. In this work, we synthesized an Ag+ ion-doped Ti/TiO2 nanotube Array Schottky junction through a facile electrochemical synthesis strategy. Subsequently, an n/n heterostructure was introduced by coating the TNTA photoanode with an n-type stibnite (Sb2S3) layer, (denoted as TNTA-Ag/Sb2S3) was chosen for its suitable band gap position and high visible light response. Scanning electron microscopy (SEM) was used to study the surface morphology, while X-ray photoelectron spectroscopies (XPS) was employed to showcase the elemental composition of the synthesized photoanode. We have successfully demonstrated that Ag+ ion doped TNTA/Sb2S3 shows a photocurrent density of 6.5 mA cm-2 vs. RHE in 0.5 M Na2SO3 (pH ~ 9.5) under AM 1.5 G illuminations, which is almost 24 times and 1.8 times greater than that of the pristine TNTA and TNTA/Sb2S3 photoanodes, respectively. As per my knowledge, this is the highest phototresponse received and the first study has been carried out yet for TNTA-Ag/Sb2S3 photoanode in PEC water splitting applications. Moreover, the TNTA-Ag/Sb2S3 photoanode has shown the maximum Applied Bias Photon-to-Current Efficiency (ABPE) of 3.36%. It is suggested that the increased PEC performance of Ag+ ion-doped TNTA/Sb2S3 is due to the enhanced conductivity of TNTA resulting from increased oxygen vacancies formed, the broad optical activity of Sb2S3, and reduced recombination of photogenerated charge carriers.

***Keywords:*** *PEC, Stibnite, TNTA Schottky junction*

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