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Synthesis of oxygen deficient bismuth oxide photocatalyst for improved photoelectrochemical applications

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Abstract

The present paper reports the effect of nitrogen modification on photoelectrochemical (PEC) water oxidation behavior of Bi2O3 semiconductor thin film. The semiconductor particles were synthesized via hydrothermal route using Bi(NO3)3 as a Bi3þ ion precursor and urea as the nitrogen source followed by drop-cast the particles and annealing the film at 600 _C. The synthesized Bi2O3 exhibited band gap energy of 3.01 eV, calculated from the UVevisibleabsorption spectrum which decreases to 2.75 eV through N-modification. Water oxidation behavior of the material has been tested through linear sweep voltammetry under periodic illumination. Highest photo-current of 180 mAcm_2 has been measured for water oxidation reaction at 0.95 V vs. Ag/AgCl, under illumination of 35mWcm_2. N-incorporation can enhance the photocurrent up to 50% whereas the visible responsiveness of the material improves significantly as confirmed from electrochemical action spectra and UVevisible absorption spectra. The photocatalytic activity of the semiconductor particles was confirmed through decoloration of Rhodamine-B dye, by spectrophotometric measurements.