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Enhanced Photoelectrochemical Water Splitting Coupled with Pharmaceutical Pollutants Degradation on Zr:BiVO4 Photoanodes by Synergetic Catalytic Activity of NiFeOOH Nanostructures

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Abstract : Global energy crises and water pollution have negatively impacted sustainable development in recent years. It is most promising to use Bismuth vanadate (BiVO4) as an electrode for photoelectrocatalytic (PEC) oxidation of water and pollution degradation. However, BiVO4 anodes suffer from poor charge separation and slow water oxidation. In this paper, a Zr:BiVO4/NiFeOOH heterojunction was successfully prepared by electrodeposition and photoelectrochemical transformation process. The method resulted in a notable 5-fold improvement in photocurrent features (1.27 mAcm−2 at 1.23 VRHE) and a lower onset potential of 0.6 VRHE. Photoanodes with high photocatalytic features and high photocorrosion resistance may be attributed their high conformity and amorphous nature of the coating. In this study, PEC was compared to electrocatalysis (EC), and the effect of bias potential on PEC degradation was discussed for tetracycline (TCH), riboflavin, and streptomycin. In PEC, TCH was degraded in the most efficient way (96 %) by Zr:BiVO4/NiFeOOH, three times larger than Zr:BiVO4 and EC (55 %). Thus, this study offers a potential solution for oxidizing PEC water and treating water pollution.

Keywords : photoelectrochemical, water splitting, pharmaceutical pollutants degradation, photoanodes, cocatalyst
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