Morphology and Interfacial Energetics Controls of Nanostructured Arrays for Efficient Photoelectrochemical Water Splitting

Jih-Jen Wu
Department of Chemical Engineering, National Cheng Kung University, Tainan 701, Taiwan
wujj@mail.ncku.edu.tw

Scheelite-monoclinic bismuth vanadate ($BiVO_4$), which exhibits proper band gap of ~2.4 eV for solar light absorption and suitable valence band edge position for oxygen evolution, is one of the most attractive visible-light-driven photocatalysts for water oxidation. However, intrinsic $BiVO_4$ shows an inferior photocatalytic activity due to its poor charge transportation and slow hole kinetics of oxygen evolution reaction. A $BiVO_4$/ZnO nanodendrite (ND) heterojunction array has been constructed by the conformal formation of thin $BiVO_4$ layers on the ZnO ND array. The $BiVO_4$/ZnO ND heterojunction array photoanode can be fully-depleted at a low external potential by the electric fields developed in radial directions of the nanorods. Therefore, the obstacle of poor charge transport in intrinsic $BiVO_4$ can be overcome. With the addition of co-catalyst cobalt phosphate (Co-Pi) on the surface, the PEC performances of the Co-Pi/$BiVO_4$/ZnO ND heterojunction array photoanode are significantly improved compared to the bare $BiVO_4$/FTO one.