

Improving light-harvesting and catalytic efficiency of water oxidation photoanodes with nanoparticle-polymer hybrid films

김현우, 전다솜, 류정기[†]
울산과학기술원
(jryu@unist.ac.kr[†])

Solar water oxidation has been recognized as a promising technology to produce clean energy resources using unlimited solar energy. In principle, semiconducting materials with a proper bandgap and band-edge positions can be used for solar water oxidation. However, most semiconducting materials have low photocatalytic efficiency due to their intrinsic problems such as narrow absorption band with a low light-absorption coefficient or slow water oxidation kinetics. To address these problems, it is necessary to develop a comprehensive strategy to modify semiconducting materials. In this study, we successfully developed a highly efficient water oxidation photoanode through the integration of functional materials on semiconductor surfaces with layer-by-layer assembly methods. The performance of the photoanodes were significantly improved after the modification with these components due to their respective roles: improved light harvesting in the band absorption by Ag nanoparticles(NPs), utilization of Infrared light by upconversion NPs, suppression of surface recombination by polyelectrolyte passivation, and increased catalytic activity by polyoxometalate catalysts.