

The Effect of NaYF₄ Upconversion Nanoparticles for the Enhancement of ZnFe₂O₄/TiO₂
Photoanode

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The photoelectrochemical (PEC) system converts solar energy into chemical energy by means of photoelectrodes as a critical component, which determines the efficiency of the system by absorbing the photons. However, most of the light-absorbing photocatalysts are composed of large bandgap and only able to utilize a short range from the ultraviolet (UV) to the visible wavelengths. Therefore, the near-infrared (NIR) regions of the solar radiance spectrum are left unattended. Upconversion nanoparticles (UCNPs) generate unique photoluminescence properties. In specific, UCNPs absorb NIR light and emit the UV and visible light. So, UCNPs can be the possible solution to improve the efficiency of PEC systems. In this report, we have studied the effects of UCNPs towards the ZnFe₂O₄/TiO₂ (ZFO/TiO₂) photoanode for enhancement of photocatalytic oxygen evolution reaction. Due to the visible light-absorbing ability of ZFO, the ZFO/TiO₂ photoanode showed superior enhancement. The applied bias photon-to-current efficiency of the ZFO/TiO₂ photoanode with the UCNP was calculated to be 1.5 times higher than that of without UCNP.