

(Research Article 3)

“Phase-junction Ag/TiO₂ nanocomposite as photocathode for H₂ generation”

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Abstract:

Developing anatase/rutile phase-junction in TiO₂ to construct Z-scheme system is quite effective to improve its photoelectrochemical activity. In this work, the anatase/rutile phase-junction Ag/TiO₂ nanocomposites are developed as photocathodes for hydrogen production. The optimized Ag/TiO₂ nanocomposite achieves a high current density of 1.28 mA cm⁻², an incident photon-to-current conversion efficiency (IPCE) of 10.8 %, an applied bias photon-to-current efficiency (ABPE) of 0.32 at 390 nm and a charge carriers' lifetime up to 2000s. Such enhancement on photoelectrochemical activity can be attributed to: (i) the generated Z-scheme system in the anatase/rutile phase-junction Ag/TiO₂ photocathode enhances the separation, diffusion and transformation of electron/hole pairs inside the structure, (ii) Ag nanodots modification in the anatase/rutile phases leading to the tuned band gap with enhanced light absorption and (iii) the formed Schottky barrier after Ag nanodots surface modification provides enough electron traps to avoid the recombination of photogenerated electrons and holes. Our results here suggest that developing phase-junction nanocomposite as photocathode will provide a new vision for their enhanced photoelectrochemical generation of hydrogen.