

Plasmonic and passivation effects of Au decorated RGO@CdSe nanofilm uplifted by CdSe@ZnO nanorods with photoelectrochemical enhancement

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Here, we demonstrate that the photoactivity of gold (Au)-decorated two-story hetero-nanostructures for photoelectrochemical (PEC) efficiency can be effectively enhanced by the plasmonic effect between Au and semiconductors in the visible region and by the passivation effect in the UV region. An Au-decorated two-story hetero-nanostructure was prepared as follows. The upper story is a novel hetero-nanofilm consisting of a reduced graphene oxide (RGO) nanofilm covered by a large area of crystalline CdSe nanolayer with a (111) plane outside and a thickness less than 8 nm; the bottom story consists of CdSe-coated ZnO hetero-nanorods. In the visible region, the plasmonic effects between Au and other materials, such as ZnO, CdSe and RGO, were analyzed separately by reassembling the component ZnO nanorods, the CdSe layer and the RGO nanofilm. The photoconversion of the two-story hetero-nanostructure can be improved via the plasmonic effects between Au and n-type semiconductors, such as ZnO and CdSe, due to the stronger Schottky rectifier effects and hot-electron injection. In the UV light region, the photoconversion can be dramatically enhanced.