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Enhancement of Photocatalytic Water Splitting of α-Fe_2O_3 under Visible Illumination by Plasmonic Gold Nanorods

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Abstract

We present surface enhanced photoelectrochemical performance of hematite by coating thin film hematite electrode by well-defined gold nanorods in a top configuration. Gold nanorods are self-assembled onto the hematite thin film electrode through strong interaction between the gold's positively charged surface and hematite surface functionalized with negatively charged polyelectrolyte. Photoelectrochemical performance of the Plasmon active substrate for water splitting reaction is described. Scanning Electron Microscopy (SEM), UV-Vis Absorbance Spectra, Cyclic Voltammetry (CV) and Wavelength dependent photocurrent spectra are used to characterize the photoelectrochemical performance of the gold nanorods modified α-Fe_2O_3 photoelectrode. A pronounced enhancement of absorbance of α-Fe_2O_3 in visible area corresponding to the surface plasmon of gold is observed, and photoelectrochemical water splitting efficiency at wavelength near Plasmon resonance is observed and attributed to the enhanced visible light absorption of hematite thin film in the presence of Plasmon active gold nanorods. Such enhancement is found to be dependent on the hematite film thickness and coverage of gold nanorods.