

### Visible light-induced stable HER performance using duality of ultrafine Pt NPs in a Z-scheme p-n junction $\text{Fe}_2\text{O}_3$ @Pt@FeS catalyst

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In this study, FeS was chosen as the photocatalyst to compare the effects of  $\text{Fe}_2\text{O}_3$  and iron oxides and sulfides on absorption in the visible region. In addition, by chemically combining  $\text{Fe}_2\text{O}_3$  and FeS, synergy between the two catalysts was confirmed, and a high-efficiency catalyst was prepared by adding a small amount of Pt, which has excellent photoelectron trapping power. The synthesized catalyst showed increased charge separation efficiency in Photocurrent due to the self-redox properties of a small amount of  $\text{Pt}^{2+}$  present between  $\text{Fe}_2\text{O}_3$  and FeS, and showed low photoluminescence. In addition, when electrons in VB of  $\text{Fe}_2\text{O}_3$  under visible light are excited to CB and move to VB of p-type FeS, the SPR effect of Pt NP mounted on n-type  $\text{Fe}_2\text{O}_3$  particles and the electron absorption ability of Pt NP mounted on p-type FeS particles are affected. As a result, the photoactivity of the composite catalyst loaded with Pt was increased by about 5 times compared to the single catalyst.