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Preparation of a Novel Fe₂O₃-MoS₂-CdS Ternary Composite Film and its Photoelectrocatalytic Performance

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Abstract: A novel Fe₂O₃-MoS₂-CdS film was fabricated by electrodeposition, hydrothermal reaction and chemical bath deposition. Its photoelectrochemical (PEC) performance for water oxidation and pollutants removal under visible light were studied. The results indicated that it is an effective strategy to fabricate the ternary heterojunction by Fe₂O₃, MoS₂ and CdS. The photocurrent density of Fe₂O₃-MoS₂-CdS composite increases by 40 times relative to pure Fe₂O₃ at 0.45 V vs. Ag/AgCl in 0.1 M NaOH aqueous solution under visible light irradiation. Among the tested films, Fe₂O₃-MoS₂-CdS exhibited the highest PEC activity for phenol degradation. The highest degradation efficiency (90.47%), rate constant (0.0076 min⁻¹) and electrochemical enhancement value (97.37%) were achieved under the optimized conditions. Hydroxyl radicals and superoxide radicals were considered as main active species. The excellent PEC performance was attributed to the ternary heterojunction structure formed by Fe₂O₃, MoS₂ and CdS, which efficiently reduced charge transfer resistance, facilitated charge transfer, and improved photoelectric conversion efficiency. Fe₂O₃-MoS₂-CdS is a promising composite material for PEC application in water oxidation and pollutants removal.

Keywords: Fe₂O₃-MoS₂-CdS; Visible light; Photoelectrocatalytic; Water oxidation; Phenol removal

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