Facile Synthesis of TiS₂/CsPbBrI₂ Heterostructures for Hydrogen Evolution Reaction

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**Abstract**: Hydrogen Evolution Reaction (HER) catalysis is pivotal for advancing sustainable hydrogen production, necessitating the development of efficient and robust materials [1, 2]. In this work, TiS₂/CsPbBrI₂ heterostructures were synthesized and characterized as potential catalysts for HER applications. A solution-phase synthesis method was utilized to create well-defined heterostructures, ensuring a high degree of interfacial interaction and structural integrity.

Comprehensive characterization using X-ray diffraction (XRD), scanning electron microscopy (SEM), and high-resolution transmission electron microscopy (HR-TEM) confirmed the successful integration of TiS₂ and CsPbBrI₂ into a hybrid system with nanoscale precision. Optical properties were analysed via UV-Vis spectroscopy. Electrochemical evaluation i. e. cyclic voltammetry (CV), demonstrated excellent catalytic activity with a low overpotential, high current density, and superior stability under acidic conditions.

The TiS₂/CsPbBrI₂ heterostructures leveraged the synergistic effects of TiS₂’s high conductivity and CsPbBrI₂’s tuneable band structure [3, 4], resulting in efficient charge transfer and enhanced catalytic performance. These results position the heterostructures as promising candidates for next-generation HER catalysts, offering a pathway to scalable and eco-friendly hydrogen production.

References:

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