Title (2)	:	**One-pot hydrothermal synthesis of MgIn2S4@NH2-MIL-125(Ti) Z-scheme heterojunction for efficient photocatalytic H2 evolution**
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Abstract	:	Photocatalytic hydrogen production through water splitting offers a green alternative to fossil fuels. In this study, a novel binary nanocomposite, MgIn2S4@NH2-MIL-125(Ti) (MIS@TIM), was fabricated via a hydrothermal-assisted method to construct a direct Z-scheme heterojunction. The integration of the visible-light-responsive MIS with the highly porous and photoactive TIM facilitates efficient charge separation and directional electron transfer, thereby enhancing photocatalytic performance. Comprehensive structural, morphological, and optical characterizations confirmed the successful formation of the heterojunction and its favorable interfacial contact. Under visible-light irradiation, the optimized MIS@TIM composite (30 wt% TIM) achieved a remarkable hydrogen evolution rate of 2247 μmol g−1 h−1, representing ∼26-fold enhancement over TIM and ∼32-fold over MIS, highlighting the synergistic effect of the Z-scheme architecture in promoting photocatalytic efficiency. The MIS@TIM composite showed strong photostability with sustained hydrogen production for 16 h under visible light. Performance was optimized through sacrificial agent, TEOA, and catalyst loading studies, achieving an AQY of 7.5% at 420 nm and an SY of 1.72 μmolh−1cm−3. Mechanistic analysis confirmed efficient charge transfer and active species involvement, highlighting MIS@TIM as a promising, noble-metal-free photocatalyst for sustainable hydrogen generation.