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Dual Metal Organic Framework Derived N-Doped Fe3C Nanocages Decorated with Ultrathin ZnIn2S4 Nanosheets for Efficient Photocatalytic Hydrogen Generation

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Abstract : Highly efficient and stable co-catalysts materials is of great important for boosting photo charge carrier's separation, transportation efficiency, and accelerating the catalytic reactive sites of semiconductor photocatalysts. As a result, it is of decisive importance to fabricate low price noble metal free co-catalysts with high catalytic reactivity, but it remains very challenging. Considering this challenge here, dual metal organic frame work derived N-Doped Fe3C nanocages have been rationally designed and decorated with ultrathin ZnIn2S4 nanosheets for efficient photocatalytic hydrogen generation. The fabrication strategy precisely integrates co-catalyst nanocages with ultrathin two-dimensional (2D) semiconductor nanosheets by providing tightly interconnected nano-junctions and helps to suppress the charge carrier's recombination rate. Furthermore, constructed highly porous hybrid structures expose ample active sites for catalytic reduction reactions and harvest visible light more effectively by light scattering. As a result, fabricated nanostructures exhibit superior solar driven hydrogen evolution rate (9600 µmol/g/h) with an apparent quantum efficiency of 3.6 %, which is relatively higher than the Pt noble metal co-catalyst systems and earlier reported ZnIn2S4 based nanohybrids. We believe that the present work promotes the application of sulfide based nanostructures in solar driven hydrogen production.

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