In-situ coupled $MAPbI_3$/r-GO heterostructure instigating highly efficient photocatalytic hydrogen generation under white light LED illumination

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Abstract

Lead halide perovskite has emerged as an optimistic material for photocatalytic hydrogen evolution owing to its excellent optoelectronic properties. However, designing an efficient and stable photocatalyst system still remain a challenging task. Pristine $MAPbI_3$ shows lesser hydrogen evolution activity due to lack of reactive sites and its faster degradation. In this work, r-GO was assembled with $MAPbI_3$ microcrystals by *in-situ* crystallization process to construct a robust and efficient heterostructure resulting a strong interconnection between $MAPbI_3$ and r-GO. The strongly anchored r-GO attributed to effortless photogenerated charge separation and transport for protons reduction in aqueous HI medium. This is one of the few works where improved photocatalytic hydrogen evolution activity was achieved with lesser co-catalyst loading percentage (2.5 wt.%, 5 wt.% and 7.5 wt.%) under white light LED illumination instead of expensive xenon lamp. Under optimal reaction condition, the hydrogen evolution rate can reach up to 4593 μmol g^{-1} h^{-1}. This finding offers a useful modified fabrication strategy for robust heterojunction resulting an efficient and stable photocatalyst for hydrogen generation.

Keywords: *$MAPbI_3$, perovskite, photocatalysis, LED illumination, hydrogen evolution, in-situ crystallization.*