Efficient charge separations in optimally oxidized $Cu_xZn_{1-x}S$ photocatalysts for enhanced solar H_2 production

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Solar water splitting is a attractive way of producing hydrogen from the renewable natural resources, and heterostructure photocatalysts have been widely investigated in photocatalytic applications. In this work, flower-shaped $Cu_xZn_{1-x}S$ composite photocatalysts were prepared with various copper contents and then the composites were further treated under controlled oxygen concentrations in high temperature furnace. The efficient photo-generated charge transfer was conducted by introduction of oxide materials which constructed the Z-scheme assisted type-Ⅱ heterosystem. The maximum hydrogen production rate was acheived as 595 μmol/g/h from the optimally oxidized $Cu_{0.05}Zn_{0.95}S$ photocatalyst. This could be mainly attributed to the highest Cu_2O crystalline phase fraction as confirmed by XRD measurement. High light absorption and low charge recombination in hetero-system were also crucial. Therefore, overall photocatalytic efficiency of the oxidized composite photocatalysts can be enhanced by optimizing their atomic contents and crystal phase fractions.