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A novel Z-scheme $\text{Er}^{3+}:\text{YAlO}_3/\text{Ta}_2\text{O}_5\text{-CaIn}_2\text{S}_4/\text{MoSe}_2$ -reduced graphene oxide photocatalyst with superior photocatalytic hydrogen evolution activity

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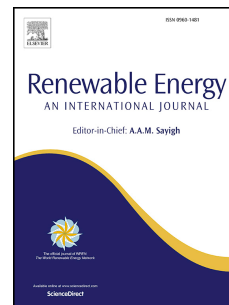
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**A novel Z-scheme Er³⁺:YAlO₃/Ta₂O₅-CaIn₂S₄/MoSe₂-reduced
graphene oxide photocatalyst with superior photocatalytic
hydrogen evolution activity**

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ABSTRACT

Here, a high effective visible-ultraviolet up-conversion luminescence agent (Er³⁺:YAlO₃) was synthesized and the Er³⁺:YAlO₃/Ta₂O₅ composite was prepared by sol-gel method. The MoSe₂-reduced graphene oxide (MoSe₂-RGO) hybrid as co-catalyst was prepared by hydrothermal method. Afterwards, a new Z-scheme photocatalyst, Er³⁺:YAlO₃/Ta₂O₅-CaIn₂S₄/MoSe₂-RGO, was successfully assembled by hydrothermal methods for visible-light photocatalytic hydrogen evolution. The Er³⁺:YAlO₃, MoSe₂-RGO, Er³⁺:YAlO₃/Ta₂O₅, CaIn₂S₄/MoSe₂-RGO, Er³⁺:YAlO₃/Ta₂O₅/MoSe₂-RGO and Er³⁺:YAlO₃/Ta₂O₅-CaIn₂S₄/MoSe₂-RGO were all characterized by X-ray diffractometer (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Energy dispersive spectrometer (EDS), Raman spectroscopy and X-ray photoelectron spectroscopy (XPS). The UV-vis absorption spectra and photoluminescence (PL) spectra of Er³⁺:YAlO₃ were also measured. The photocatalytic hydrogen production activity of Er³⁺:YAlO₃/Ta₂O₅-CaIn₂S₄/MoSe₂-RGO was examined under visible-light irradiation. In addition, the reused times of Er³⁺:YAlO₃/Ta₂O₅-CaIn₂S₄/MoSe₂-RGO for photocatalytic hydrogen production were investigated. The results showed that the

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