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Solar-hydrogen production with reduced graphene oxide supported metal chalcogenides

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Hydrogen, as a clean/green and renewable energy storage and carrier has great potential for decreasing CO_2 emission and thus, resolving the global warming problems. One of the most suitable methods to produce clean and pure hydrogen fuel is to split water by utilization of solar light. For photocatalytic and photoelectrochemical hydrogen evolution reactions, photoactive materials, semiconductors, should have an optimal band structure for maximum utilization of solar energy, suitable band positions and stability against photocorrosion. Usually, transition metal chalcogenides (TMC) have been considered as an ideal photocatalysts for visible light driven hydrogen evolution reaction (HER). However, photoelectrocatalytic activity of TMC is restricted by the fast recombination of photogenerated charges and photocorrosion. One of the possible ways to minimize these problems is to couple TMC with wider band gap semiconductors and graphene derivatives, e.g. reduced graphene oxide (RGO). Therefore, in this work, we have tried to enhance the hydrogen production efficiency of CdxZn1-xS photocatalysts by decorating it with RGO as prepared RGO¬-CdxZn1-xS composites have been tested in order to find their possible usage in photocatalytic and photoelectrochemical hydrogen production processes. CdxZn1-xS photocatalyst were decorated on RGO by usage of a new synthetic method in which particles features were easily controlled by decorating proposed particles into RGO sheet. The optimized photocatalysts and photoanodes were tested for water splitting in sacrificial agent medium and performance of the composite photocatalysts such as stability and efficiency were determined. The presence of RGO in CdxZn1-xS as an electron collector and transporter increased the photocatalytic activity and photocurrents of the photoelectrodes due to the increase not only in the life-time of photo-generated charge carriers but also in the light absorption as a result of the scattering of the incident light.