

Hydrogen as a sustainable source of renewable energy

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Sustainable energy involves increasing production of renewable energy, making safe energy universally available, and energy conservation. Guri Dam, a hydroelectric dam in Venezuela. Source: Wikipedia. Credit: Wikipedia By Warairarepano&Guaicaipuro - Own work, CC0, commons.wikimedia.org/w/index.php?curid=64060186

Researchers from the University of Chemistry and Technology in Prague conducted research dealing with the photocatalytic activity of twist-angle stacked 2D TaS₂.

With increasing demands in modern society, the [energy crisis](#) and environmental problems are currently in the spotlight. Hydrogen is the primary sustainable source of renewable energy and is highly required for advanced energy conversion systems. Recently, photoelectrocatalytic and photoelectrochemical water-splitting methods are efficient approaches for the scalable generation of hydrogen.

The concept of light-induced [energy production](#) through semiconductor catalysts attracted many research efforts to develop low-cost, efficient bifunctional materials for [hydrogen production](#) and environment-sensing response. "The performance of these materials can be tuned while illuminating the light of various wavelengths. The occurred photo-induced [electron transfer](#) in the targeted nanosheets-based sensitive material will generate photoelectrochemical water splitting, e.g., faster hydrogen evolution reaction (HER) or broadband light-sensitive detector," says principal researcher Evgeniya Kovalska. And adds "these will pave new ways for emerging materials as a cheaper and more productive alternative to most common fossil fuels-based methods of hydrogen production as well as traditional photodetectors."

The low-cost, efficient photoelectrosensitive electrodes as an alternative to expensive and complex rigid systems are yet in demand for advanced photoresponsive technology. In the research, the light-induced efficiency of electrochemically exfoliated TaS₂ nanosheets for hydrogen generation catalysis and photodetectors was demonstrated. Mutual twisting of the exfoliated 2H-TaS₂ flakes leads to the redistribution of charge density induced by interlayer interaction of the individual nanosheets. External light irradiation on the TaS₂ surface influences its conductivity making the material feasible for photoelectrocatalysis and

photodetection. The TaS₂-based photoelectrocatalyst demonstrates high [hydrogen](#) evolution reaction (HER) activity. The TaS₂-integrated photodetector in the acidic medium represents its broadband response with the highest photoresponsivity toward 420 nm light illumination. "This finding will pave the way to a new realization of exfoliated twist-angle stacked TaS₂ for photo-induced electrochemistry and sensing," concludes Kovalska.

The study is published in Nature's *npj 2D Materials and Applications*.

More information: Evgeniya Kovalska et al, Photocatalytic activity of twist-angle stacked 2D TaS₂, *npj 2D Materials and Applications* (2021). DOI: [10.1038/s41699-021-00247-8](https://doi.org/10.1038/s41699-021-00247-8)

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