Hydrogen as a Sustainable Source of Renewable Energy

2021-08-28
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 E. Kovalska.

See more in an original article published in Nature. Text is based on the research text manuscript.

The University of Chemistry and Technology, Prague is a natural center of first-rate study and research in the area of chemistry in Czechia. It is one of the country’s largest educational and research institutions focused on technical chemistry, chemical and biochemical technologies, material and chemical engineering, food chemistry, and environmental studies.

Read the original article on Medium.