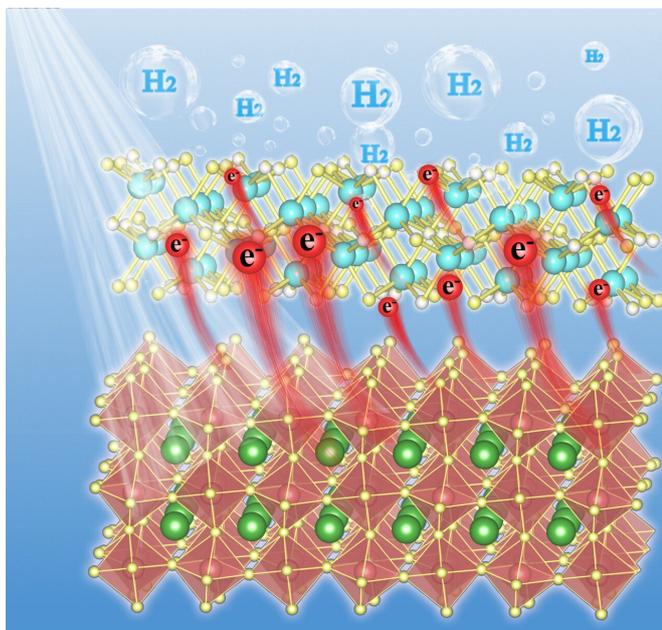


Expediting hydrogen creation with a non-noble metal cocatalyst under visible light

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Hydrogen evolution over Mo₂C@MAPbI₃. Credit: Shanghai Key Lab of Chemical Assessment and Sustainability, School of Chemical Science and Engineering, Tongji University

Halide perovskites have been emerging as promising photocatalytic materials for H₂-evolution from water due to their outstanding photoelectric properties. However, the lack of proper surface reactive sites greatly hinders the photocatalytic potential of these fascinating compounds. In this work, Mo₂C nanoparticles have been anchored onto methylammonium lead iodide (MAPbI₃) as a non-noble-metal cocatalyst to promote H₂-evolution reactions.

The team published their work on May. 28 in *Energy Material Advances*.

"Photocatalytic water splitting has been considered as a promising route to store [solar energy](#) as hydrogen energy," said paper author Xiaoxiang Xu,

professor with the Shanghai Key Lab of Chemical Assessment and Sustainability, School of Chemical Science and Engineering, Tongji University. "Currently, halide perovskites have been gained great interest as photocatalysts for H₂-evolution reactions, but they are normally deficient in surface reactive sites where photocarriers cannot be promptly transferred for surface redox reactions."

Xu explained that the extremely acidic environment needed to stabilize halide perovskites in an aqueous solution restrains the choices of H₂-evolution cocatalyst that can be deposited.

"The noble-metal cocatalyst Pt has been introduced to promote H₂-evolution reactions but is still unsatisfactory probably due to the poor Pt/halide perovskite interfaces," Xu said. "Robust non-noble-metal-based cocatalysts have gained serious attention as alternatives to noble-metal cocatalyst."

However, their connections with halide perovskites are generally very weak often due to structural mismatch thereby preventing fast charge migrations from halide perovskites to these cocatalysts. According to Xu, Mo₂C, a promising low-cost electrocatalyst for H₂-evolution reaction, exhibits excellent electrocatalytic activity over a wide pH range thereby serving as a potential candidate cocatalyst for photocatalytic H₂-evolution.

Mo₂C is one of a few compounds that are stable in strong acids, Xu said, rendering it an excellent alternative cocatalyst for halide perovskites which are stabilized in strong acid during photocatalytic reactions, e.g. HBr and HI [aqueous solution](#).

"The opposite Zeta potentials between Mo₂C and MAPbI₃ ensure firm interconnections between these compounds," Xu said. "In this paper, we illustrated recent research expediting H₂-evolution over MAPbI₃ with a non-noble metal cocatalyst Mo₂C under visible light."

"We have successfully loaded Mo₂C nanoparticles onto MAPbI₃ by an electrostatic-assembly method to fabricate Mo₂C@MAPbI₃ composites," Xu said.

"The Mo₂C nanoparticles are found to be homogeneously and firmly anchored at the surface of MAPbI₃," Xu said. "Thanks to the strong interconnections between Mo₂C and MAPbI₃, Mo₂C@MAPbI₃ composites exhibit superior photocatalytic activity for H₂-evolution from water which clearly surpasses pristine MAPbI₃ and Pt deposited MAPbI₃ under the same testing conditions."

"Further analysis suggests that Mo₂C nanoparticles not only facilitate charge separation in MAPbI₃ but also substantially expedite interfacial charge transfer for water reduction reactions," Xu said. "These findings justify the Mo₂C as an efficient non-noble-metal cocatalyst for halide perovskite photocatalysts that work under a highly acidic environment."

More information: Jinxing Yu et al, Expediting H₂ Evolution over MAPbI₃ with a Nonnoble Metal Cocatalyst Mo₂C under Visible Light, *Energy Material Advances* (2022). DOI: [10.34133/2022/9836095](https://doi.org/10.34133/2022/9836095)

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