Novel metal-organic frameworks photocatalysts boost water splitting to produce hydrogen

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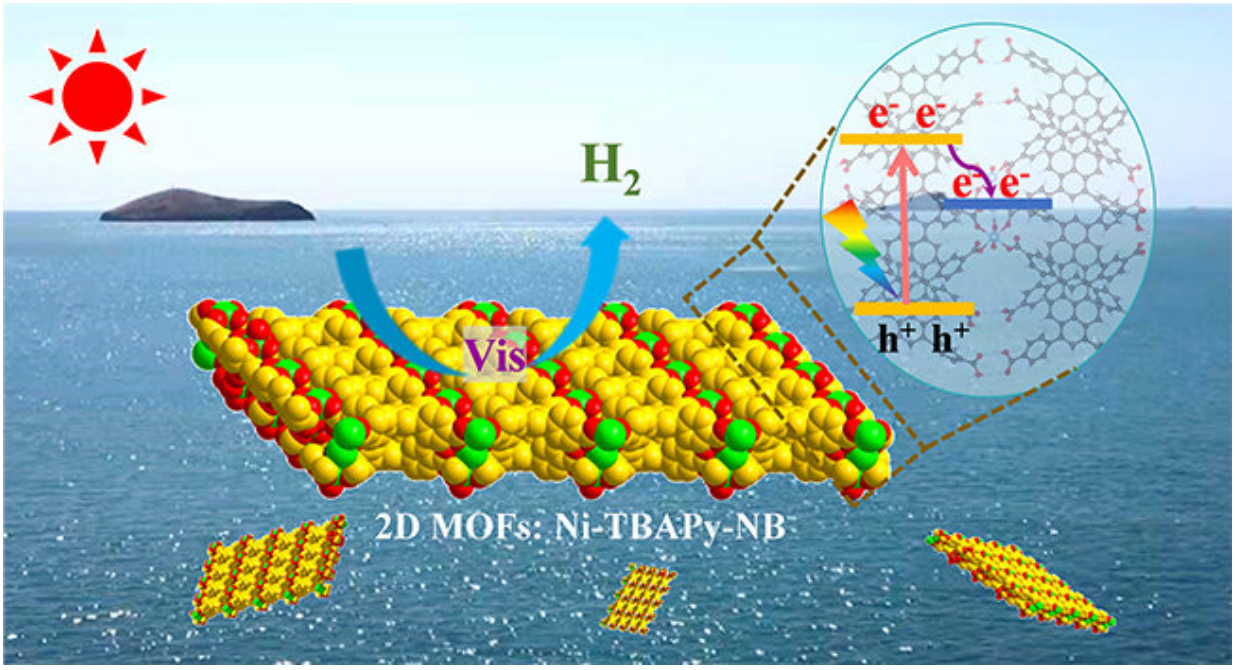

Schematic photocatalytic water splitting into hydrogen of Ni-TBAPy-NB. Credit: Liu Lifang

Photocatalytic water splitting to produce hydrogen is one of the ideal ways to convert solar energy into chemical energy. However, developing efficient photocatalysts with a wide range of visible-light absorption for this process is still challenging.

Recently, a research group led by Prof. Zhang Fuxiang from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences developed a novel wide visible-light-responsive Ni-metal-organic frameworks (MOFs) photocatalyst that could boost water splitting to produce hydrogen under visible-light irradiation.

This study was published in *Journal of the American Chemical Society* on Feb. 2.

The researchers uniformly integrated 1,3,6,8-tetrakis(p-benzoic acid)pyrene (H_4TBAPy) ligand as light-harvesting center and [Ni_3O_{16}] nickel-oxide cluster as catalytic center into the MOFs single crystal framework, and then exfoliated it into 2D Ni-TBAPy-NB nanobelts.

Benefitting from special 2D nanobelts, the ordered coordination structure and special frameworks structure contained light-harvesting center and catalytic site of the nanobelts, leading to high charge separation efficiency and water reduction activity on nanobelts. The apparent quantum efficiency of photocatalytic water splitting to produce hydrogen reached 8.0% (420 ± 10 nm excitation).

"These results provide a reference for the design and synthesis of other high-efficiency MOF-based photocatalytic materials for efficient solar-to-chemical energy conversion," said Prof. Zhang.

More information: Lifang Liu et al, Water-Stable Nickel Metal–Organic Framework Nanobelts for Cocatalyst-Free Photocatalytic Water Splitting to Produce Hydrogen, *Journal of the American Chemical Society* (2022). DOI: 10.1021/jacs.1c12179

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