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Carbon nanosheet buffer improves photocatalytic systems

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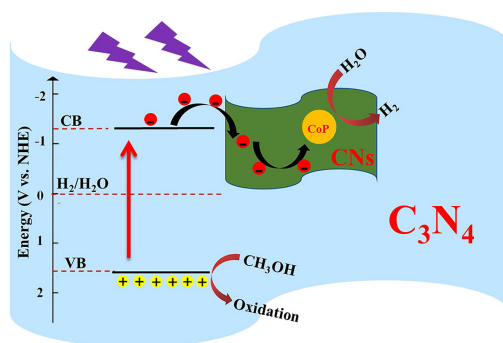


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The extra layer reduces defect density and carrier transfer resistance.



When light impinges on a photocatalyst, it drives a chemical reaction. Such photocatalytic systems are used widely in carbon dioxide reduction, water treatment, and water splitting. By decomposing water to produce hydrogen, they could represent an effective solution for energy demands and environmental problems.

However, abundant defects – stemming from introduced doping atoms, plastic deformation of the crystal, and lattice mismatch between components, among other causes – can make photocatalytic systems inefficient.

Zheng et al. optimized the interface quality and performance of a photocatalytic system consisting of graphitic carbon nitride and a CoP co-catalyst. They introduced a highly conductive carbon nanosheet layer, which reduced defect density and also the interfacial impedance.

With the nanosheet layer, the team improved the hydrogen evolution rate of the system by nearly five times. The apparent quantum efficiency, or number of hydrogen atoms compared to number of incident photons, increased by a factor of eight. Corresponding theoretical calculations indicate that the electron transition probability was enhanced by an order of magnitude.

“Up to now, electrochemical tests and photocatalytic experiments were used to explore the effect of interface optimization on the photocatalytic performance of the system,” said author Shoutian Ren. “However, the theoretical evidence on their enhanced interfacial carrier transfer rate remained insufficient and warranted further investigation.”

The approach provides a general solution for improving efficiency in other photocatalytic systems.

“We hope to find more simple and effective schemes to optimize the interface quality and further improve the performance of photocatalytic systems,” said Ren.

Source: “The introduction of carbon nanosheet buffer layer for enhanced hydrogen evolution performance of C_3N_4/CoP photocatalysts,” by Xiaochun Zheng, Shoutian Ren, Qixiao Gai, Yidi Wang, and Wenjun Liu, *Journal of Applied Physics* (2022). The article can be accessed at <https://doi.org/10.1063/5.0112887>.

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