'Growing' active sites on quantum dots for robust hydrogen photogeneration

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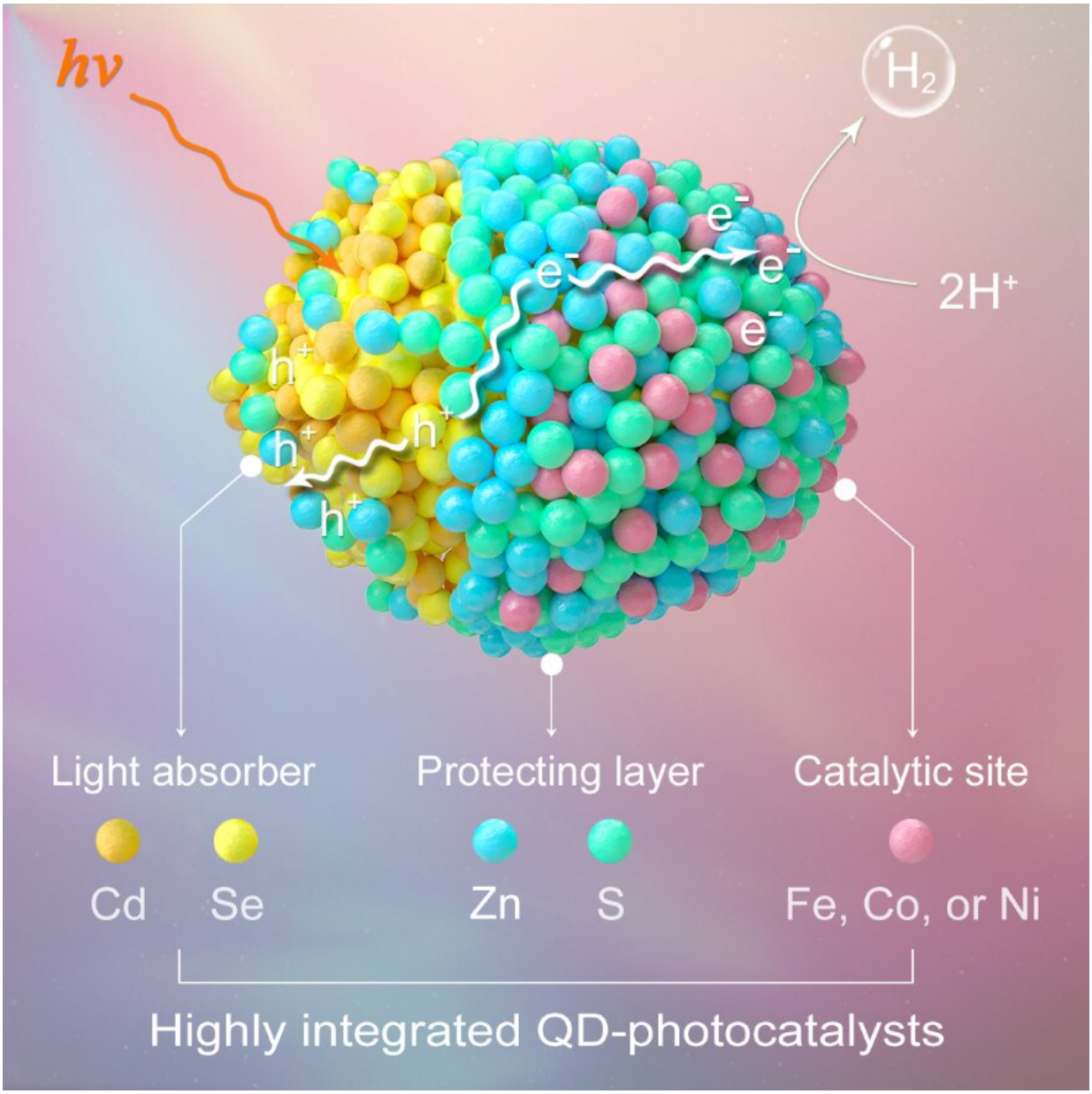

Schematic diagram of site- and spatial- selective integration of metal ions into QDs for robust H_2 photogeneration. Credit: Prof. WU's Group

Very recently, Chinese researchers had achieved site- and spatial-selective integration of earth-abundant metal ions (e.g., Fe_2^+, Co_2^+, Ni_2^+) in semiconductor quantum dots (QDs) for efficient and robust photocatalytic H_2 evolution from water.

This research, published online in *Matter*, was conducted by a research team led by Prof. Wu Lizhu and Dr. Li Xubing from the Technical Institute of Physics and Chemistry (TIPC) of the Chinese Academy of Sciences.

Photosynthesis in nature provides a paradigm for the large-scale conversion of sunlight into chemical fuels. For example, hydrogenases in certain bacteria and algae catalyze the reversible reduction of protons to H_2 with remarkable activity.

Inspired by natural photosynthesis, solar-driven H_2 evolution from water is regarded as an ideal pathway to store solar energy in chemical bonds. In pursuit of highly efficient chemical transformation, QDs in conjunction with non-noble metal ions have appeared as the cutting-edge technology of H_2 photogeneration.

This research successfully realized the cooperative and well-controlled loading of non-noble metal ions in QDs, thereby integrating a light absorber, protecting layer and active site together in an ultra-small nanocrystal, which would show great potential in fabricating artificial photosynthetic devices for scale-up solar-to-fuel conversion.

Time-resolved spectroscopic techniques and density functional theory

calculations reveal the kinetics of interfacial charge transfer and the mechanism of H_2 evolution at active species, which provides new guidance on the design of multifunctional photocatalysts for practical applications.

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More information: Yu-Ji Gao et al, Site- and Spatial-Selective Integration of Non-noble Metal Ions into Quantum Dots for Robust Hydrogen Photogeneration, *Matter* (2020). DOI: 10.1016/j.matt.2020.06.022

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