Tailoring morphology symmetry of bismuth vanadate photocatalysts for efficient charge separation

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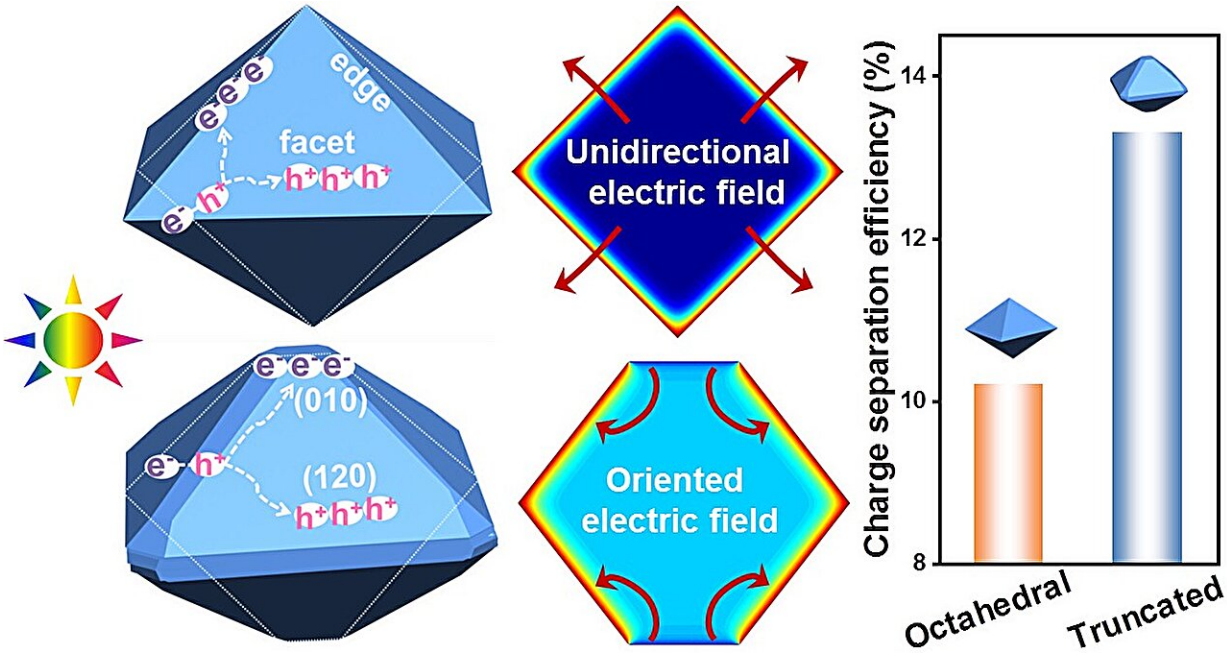

Tailoring morphology symmetry of $BiVO_4$ photocatalyst from octahedral to truncated octahedral crystals leads to the quite different separation of photogenerated charges and a significantly improved charge separation efficiency. The built-in electric field for driving photogenerated charge separation is considered to be modulated by tuning the morphology symmetry. Credit: Science China Press

In a study published in the journal *Science China Chemistry* and led by Prof. Rengui Li (State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences), a distinct charge separation difference has been found via rationally tailoring the morphology symmetry of $BiVO_4$ photocatalyst.

Interestingly, for octahedral $BiVO_4$ crystals, photogenerated electrons and holes can be separated between edges and quasi-equivalent facets. However, as for truncated octahedral $BiVO_4$, photogenerated electrons tend to transfer to {010} facets while photogenerated holes prefer to accumulate on {120} facets, thus realizing the spatial separation of photogenerated charges between different facets.

Morphology tailoring of $BiVO_4$ crystals leads to a significantly improved photogenerated charge separation efficiency and photocatalytic water oxidation activity. The built-in electric field for driving the separation of photogenerated electrons and holes is considered to be modulated by tuning the morphology symmetry of $BiVO_4$ crystals.

"Among artificial photosynthesis via photocatalytic water splitting which enables the direct utilization and storage of solar energy into chemical fuels, photo-induced charge transfer from a photocatalyst to catalytic surface sites is vital in ensuring solar energy utilization efficiency," Li says.

"Therefore, it is of great significance to explore the influence of morphology and facet on the charge separation. Based on the previous research on spatial charge separation between different facets in semiconductor crystals, taking bismuth vanadate with low-symmetry structure as a platform, this work has revealed the significant role of morphology symmetry in charge separation, which is important to facilitate the rational design of artificial photocatalysts."

More information: Yuting Deng et al, Tailoring morphology symmetry of bismuth vanadate photocatalysts for efficient charge separation, *Science China Chemistry* (2023). DOI: 10.1007/s11426-023-1753-5

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