A chemically bonded photocatalyst with rich oxygen vacancies for improved photocatalytic decontamination

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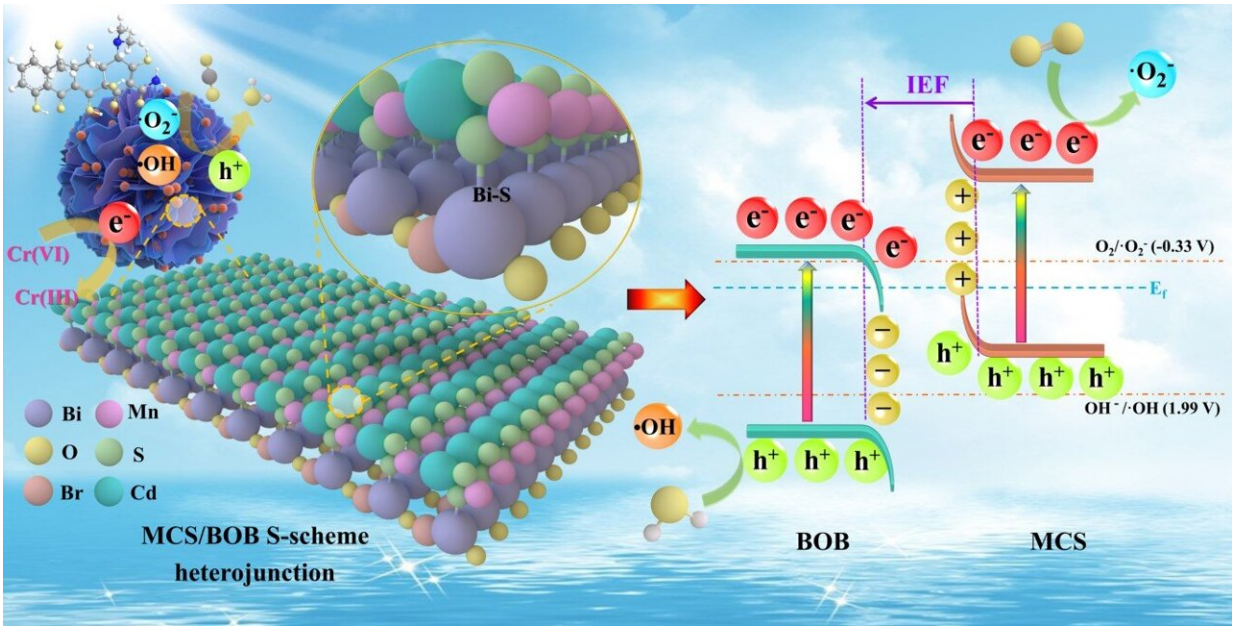

Schematic diagram of photocatalytic water decontamination mechanism. Credit: Shijie, Li et al.

A challenge in promoting the industrial application of photocatalysis technology for environment remediation lies in the design of high-performance photocatalysts. These photocatalysts should be endowed with efficient photo-carrier separation and intense redox potentials to boost photocatalytic pollutant removal.

In a study published in *Advanced Powder Materials*, a group of researchers from Zhejiang Ocean University and University of Missouri revealed the modulation of interfacial chemical bond of $Mn_{0.5}Cd_{0.5}S$/BiOBr assisted by with rich oxygen vacancies. This, in turn, elucidated the underlying mechanism for boosted photocatalytic performance.

"BiOBr is a visible-light active photocatalyst with several advantages, including a favorable band configuration, exceptional photo-oxidative capacity, distinctive 2D architecture, ecological compatibility, abundant resources and robust durability," explained Shijie Li, co-lead author of the study. "However, constrained absorption of visible light and sluggish photo-carrier diffusion and segregation hamper its practical application."

The team developed an S-scheme photosystem of $Mn_{0.5}Cd_{0.5}S$/BiOBr with interfacial bond and oxygen defects, constructed by pinning $Mn_{0.5}Cd_{0.5}S$ nanoparticles on BOB microflowers. This was devised for efficacious decontamination of antibiotics and Cr(VI).

"Physical contact without chemically bonding hetero-interface between the two components, which is insufficiently interactive, generally results in an unsatisfactory charge migration passage," added Bin Zhang, co-lead and co-corresponding author.

"Besides, defect engineering is another effective strategy to upgrade the catalytic property. Thus, precise construction of chemically bonded S-scheme heterojunction with structural defects is essential for efficient photocatalytic water purification but is rarely exploited in photocatalytic applications."

The team's findings provide a feasible approach to developing outstanding catalysts for environmental protection via combining interfacial chemical bonds and defects modulated S-scheme junction.

More information: Shijie Li et al, Chemically bonded Mn0.5Cd0.5S/BiOBr S-scheme photocatalyst with rich oxygen vacancies for improved photocatalytic decontamination performance, *Advanced Powder Materials* (2024). DOI: 10.1016/j.apmate.2024.100183