Engineering the direct Z-scheme systems over lattice intergrown of MOF-on-MOF for selective CO2 photoreduction to CO

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Abstract

The direct Z-scheme provide a potential strategy for high efficient CO2 photoreduction, whereas the heterointerface contact resistance is significantly limited the interfacial electron transfer kinetic. Herein, we build the directional charge-transfer channels in a direct Z-scheme system over metal-organic frameworks (MOFs), that is the lattice-guided MOF-on-MOF hybrids, to facilitate CO2 photoreduction. The heteroepitaxial lattice growth along the c-axis of MIL-88B(Fe) via the high-activity (001) facet over the stable (111) facet of UiO-66-NH2. Theoretical calculations and experimental results provide the direct evidence that engineering direct Z-scheme of these MOFs hybrids can induce the electrons migration from UiO-66-NH2 to the holes of MIL-88B(Fe) by directional charge-transfer channels owing to their lattice match. This can dramatically boosts photocatalytic CO2-to-CO selectivity up to nearly 100%, with a rate of 2.26 μmol·g-1·h-1. This work demonstrates that the efficiently selective CO2 photoreduction processes can be achieved by engineering Z-scheme via lattice intergrown of MOF hybrids strategy.

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