B-site rock-salt-ordered Cu-based double perovskite realizes high efficiency and stable CO_2 electroreduction

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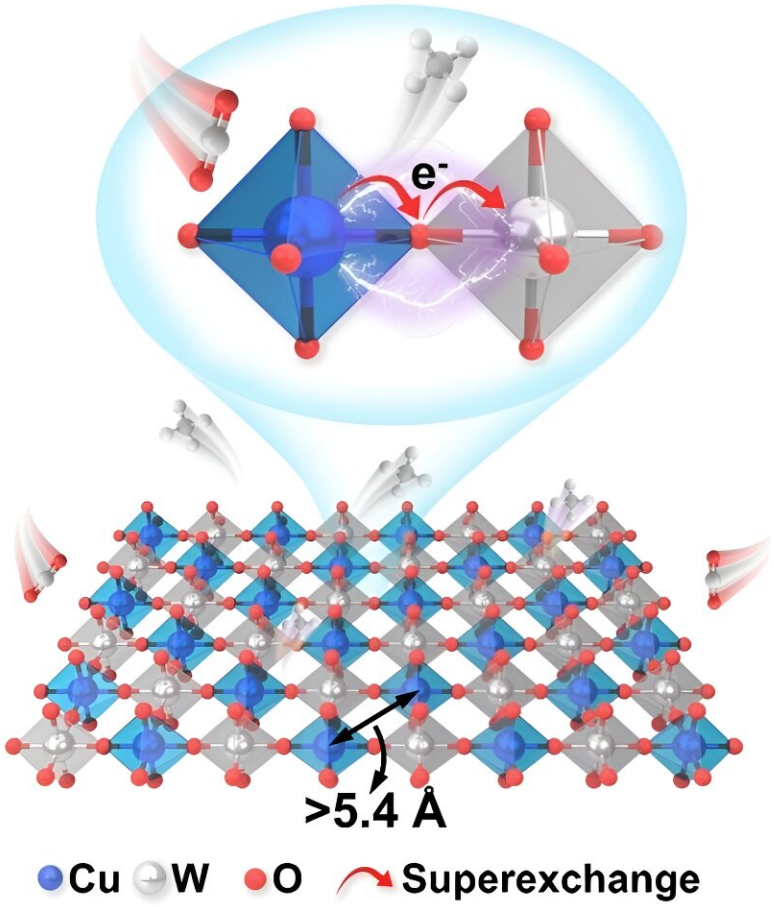

The schematic diagram of B-site rock-salt order Sr_2CuWO_6 with long Cu–Cu distance and superexchange interaction for electromethanation. Credit: Zhang Yu

Carbon dioxide electroreduction (CO_2RR) into high-value chemical feedstocks and fuels is a potential way to realize the carbon-neutral cycle. Cu-oxide-based catalysts are promising for CO_2 electroreduction, but suffer from inevitable reduction and structural collapse, leading to unstable electrocatalytic properties.

Profs. Zhu Jiawei and Jiang Heqing from the Qingdao Institute of Bioenergy and Bioprocess Technology of the Chinese Academy of Sciences have developed a B-site rock-salt-ordered double perovskite oxide of Sr_2CuWO_6 with superexchange-stabilized long-range Cu sites for efficient and stable CO_2 electroreduction.

The study was published in *Nature Communications* on Feb. 21.

The researcher used Sr_2CuWO_6 as a proof-of-concept model catalyst. The Sr_2CuWO_6 exhibited B-site rock-salt order, resulting in long Cu–Cu distance and superexchange interaction.

Its long-distance Cu sites facilitate *CO hydrogenation and inhibit C–C coupling. Meanwhile, the superexchange interaction stabilizes the Cu sites and prevents structural collapse. These factors realized the excellent performance of Sr_2CuWO_6 for stable CO_2 electromethanation, which achieved a high FE_{CH_4} of 73.1% as well as a high partial current density of 292.4 mA cm^{-2}.

Notably, Sr_2CuWO_6 presents the best performance of electromethanation in perovskite catalysts.

This work discovers efficient and stable Cu-based double perovskite oxide for CO_2RR, which opens a new avenue for rational design of more advanced Cu-based catalysts.

More information: Jiawei Zhu et al, Superexchange-stabilized long-distance Cu sites in rock-salt-ordered double perovskite oxides for CO2 electromethanation, *Nature Communications* (2024). DOI: 10.1038/s41467-024-45747-5

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