# Study provides new insights into steelmaking off-gas treatment

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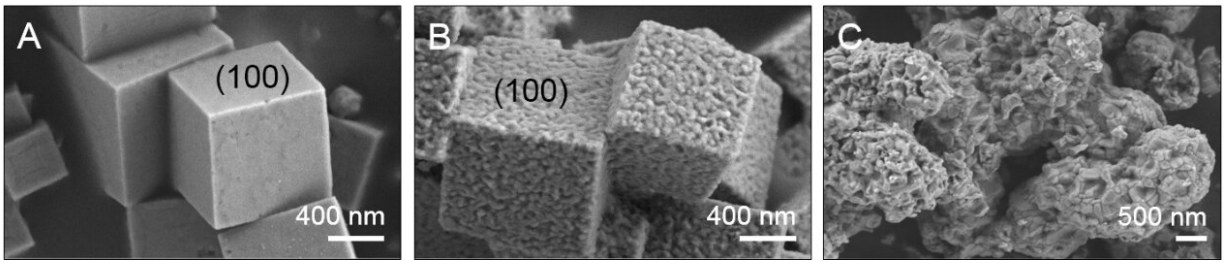


Scanning electron microscope images of the fresh $Cu_2O$ (A) and used catalyst for CC (B) and CLC (C) processes. Credit: IMCAS

Both catalytic combustion (CC) and chemical looping combustion (CLC) are promising technologies for energy saving and emission reduction of $CO_2$ in treatment of steelmaking off-gas (CO).

Recently, researchers from the Institute of Mechanics of the Chinese Academy of Sciences (IMCAS), Tianjin University of Science and Technology and Aalto University have provided new insights into the microscopic reaction mechanism of CO in CC and CLC processes over the cubic $Cu_2O$ catalyst.

The results were published in *Applied Catalysis B: Environmental*.

The researchers compared the evolution behavior and quantitative

reaction mechanisms of cube $Cu_2O$ model catalyst for CC and CLC reactions. They found that the $Cu_2O$-CC exhibited higher activity and stability than $Cu_2O$-CLC.

The typical characterization results suggested that the only surface unstable $Cu_2O$ was oxidized to CuO, showing excellent synergistic effect of metal-oxide interface between $Cu^+/Cu^{2+}$ and active lattice oxygen species for $Cu_2O$-CC reaction. However, CLC reaction caused $Cu_2O$ structure collapse and then low stability and agglomeration of $CuO_x$ species.

The researchers proposed three different active oxygen species (surface cycle lattice oxygen, bulk lattice oxygen, and adsorbed oxygen) and detailed reaction pathways.

Results showed that the intrinsic activity of surface cycle lattice oxygen was higher in terms of turnover frequency and facile formation of $C^{16}O^{18}O$ on the cubic interface of $Cu_2O$-CC through adsorbed CO during CC process.

These findings can help us to better understand the actual surface reaction process on cubic $Cu_2O$ catalyst in the CC and CLC, and provide theoretical support to the advanced catalyst design and intrinsic mechanism research for CC and CLC processes.

**More information:** Running Kang et al, Evolution behavior and active oxygen quantification of reaction mechanism on cube Cu2O for CO self-sustained catalytic combustion and chemical-looping combustion, *Applied Catalysis B: Environmental* (2022). DOI: 10.1016/j.apcatb.2022.121296