New catalyst boosts carbon dioxide electroreduction to multicarbon products

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A Cu-Cul composite catalyst achieves highly efficient production of $\text{C}_2^+$ chemicals from electrocatalytic $\text{CO}_2$ reduction. Credit: LI Hefei and LIU Tianfu

Electrocatalytic $\text{CO}_2$ reduction reaction (CO2RR), using clean electricity to convert $\text{CO}_2$ and water into chemicals and fuels, is an effective way to simultaneously close the carbon cycle and store renewable energy.

It’s difficult to generate multicarbon ($\text{C}_2^+$) products due to the multiple proton-electron transfer, the complex intermediates and the sluggish C-C coupling step during CO2RR to $\text{C}_2^+$ products, leading to low selectivity and production rate for $\text{C}_2^+$ formation.

Recently, a research team led by Prof. Wang Guoxiong, Prof. Gao Dunfeng and Prof. Bao Xinhe from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) designed a Cu-Cul composite catalyst, achieving efficient production of $\text{C}_2^+$ chemicals from CO2RR.

This study was published in Angewandte Chemie International Edition on April 10.

The researchers designed the catalyst with abundant Cu$_0$/Cu$^+$ interfaces by physically mixing Cu nanoparticles and Cul powders.

Structural characterizations indicated that the Cu-Cul composite catalyst underwent significant reconstruction under CO2RR conditions, which was induced by alkaline electrolyte and applied potential.

The high-rate $\text{C}_2^+$ production over Cu-Cul was ascribed to the presence of residual Cu$^+$ and adsorbed iodine species, which improved CO adsorption and facilitate C-C coupling.

“This work presents a new strategy for designing efficient catalysts towards high-rate CO2RR to $\text{C}_2^+$ products,” said Prof. Wang.


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