

CO₂ Conversion to Ethylene by Copper Oxide Derived Cu Electrode with Solar Energy

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Understanding electrocatalysis correlated electron configuration of catalyst surface under realistic working conditions is a prerequisite for rational design of high-performance electrocatalyst. Recently, subsurface oxide permeates the phenomenology of C–C coupling mechanism of CO₂ reduction (CO₂R) in oxide-derived Cu catalysts, which remains elusive and is a field of intensive research. Here, we used *in-situ* X-ray absorption to identify of the dynamic structure of catalytically active sites in the two oxide-derived Cu catalysts: CuO nanowires (NWs) precursor was reduced by either annealing in the presence of hydrogen (Cu NWs) or applying a cathodic electrochemical potential (Cu_xO NWs). Our results reveal oxygen in the Cu_xO NWs plays an important role in modifying the local electronic structure of copper with positive valence sites, which boost C–C coupling reaction for ethylene formation. Simulations show that the average oxidation state of copper enables control over CO adsorption and dimerization and makes it possible to implement a preference for the electrosynthesis of C₂ products. These results provide insights into the origin of C–C coupling in CO₂R.