

XANES and APXPS of Cu: Formation mechanism and chemical selectivity of a CO₂ reduction reaction catalyst

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Copper electrocatalysts derived from an oxide have shown extraordinary electrochemical properties for the carbon dioxide reduction reaction (CO₂RR). We report an in situ X-ray Absorption Spectroscopy (XAS) and in situ Ambient-Pressure X-ray Photoelectron Spectroscopy (APXPS) investigation of a copper nanocube CO₂RR catalyst with high activity and selectivity for ethylene production. The results show that the precursor for the copper nanocube formation is copper(I)-oxide, not copper(I)-chloride as previously assumed. A second route to an electrochemically similar material via a copper(II)-carbonate/hydroxide is also reported. Furthermore, we show that there is a substantial amount of residual oxygen in nanostructured, oxide-derived copper electrocatalysts.