

# Low dimensional defective copper-based electrocatalysts for energy conversion

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**Abstract:** This report presents our recent research results in low-dimensional nanostructures synthesized via wet-chemical methods for electrocatalytic and photocatalytic applications, including water splitting, CO<sub>2</sub> reduction, NO<sub>x</sub> reduction, and urea synthesis. By exploring quantum dots, nanosheets, and multi-dimensional hierarchical assemblies, we elucidate the unique catalytic properties arising from structural configurations, interfacial engineering, defect modulation, and elemental doping. The results demonstrate that tailored defect states and surface engineering enable improved photocatalytic hydrogen evolution and selective CO<sub>2</sub>-to-fuel conversion. These insights may provide experimental foundations for designing high-efficiency catalytic systems, bridging material innovation with sustainable energy conversion and environmental remediation.



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