

Morphology Effects of Electrocatalytic Carbon Dioxide Reduction onto Copper/Silver Bimetallic Nanostructures

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Nowadays, electrochemical CO₂ reduction that involves the utilization of CO₂ to convert into hydrocarbon products has been regarded as a promising way to address the increasing crisis of greenhouse effect and the energy crisis. Among numerous materials, copper material has been revealed to enhance the electrochemical CO₂ reduction activity toward the hydrocarbon products. However, the selectivity toward a specific hydrocarbon product remained relatively low and lacked precise control. In this study, the silver is introduced to alter the CO₂ reduction performance of Cu, and the resulting morphologic effects of Ag/Cu bimetallic nanomaterials are investigated to realize the optimized condition of the electrocatalyst. GC-MS is employed to analyze the CO₂ reduction products from various samples as well as the corresponding Faradaic efficiency. Cu NW@Ag Layer electrode can be revealed to exhibit the best performance toward methane with a Faradaic efficiency of approximately 60% at around -1.2 V. We conclude that the Cu NW@Ag Layer electrode is able to perform a better selectivity toward the organic fuels than that of Cu NW@Ag NP case, which can be attributed to the abundant Ag/Cu boundaries that can efficiently facilitate the formation of the key intermediate. Our system can potentially substitute for the conventional photoelectrochemical cell; thus the increasing crisis of greenhouse effect can be probably solved.

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