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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