Uniform Cu-Doped Carbon Inherited From Plant Growth for Electrocatalytic CO2 Reduction to CH4

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In observance of the fast and continuous growth of global CO2 atmospheric level, the recent development of electrocatalytic CO2 reduction features as an attractive approach that can convert excess CO2 into value-added fuels/chemicals to replace conventional fossil fuels, as well as reducing CO2 level for realizing carbon neutral economy. Key to the success of goal is the development of Cu-based electrocatalysts with accurate structural tuning, which has been intensively investigated by complicated chemical synthetic methods. Distinctive from the conventional chemical methods, here we have proposed a paradigm-shift concept of Cu catalyst growth, during which Cu ions are absorbed into a plant's root (such as bean sprouts) and homogeneously distributed. This uniform distribution of Cu ions is inherited after subsequent calcination to obtain a Cu-doped carbon nanosheet catalyst, which features efficient electrocatalytic CO2 reduction activity. Under the optimal conditions investigated in this work, this "planted Cu catalyst" enabled highly selective (~ 95%) conversion of CO2 into methane (CH4), substantially exceeding the control sample where Cu ions were directly impregnated on bean sprout's surface and calcinated. This concept of "planted catalyst" suggests a general but powerful means to prepare uniformly metal-doped electrocatalysts directly from biomass, with high and selective catalytic conversion capability.

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