Development of electrocatalysts based on non-noble metals for electrochemical carbon dioxide reduction reaction

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Artificial photosynthesis refers to the conversion of water and CO2 into value-added chemicals powered by sunlight, and is the holy grail of a sustainable carbon cycle of chemicals. Since a challenge facing this system is the conversion of stable CO2 into the desired chemicals, most studies have focused on the development of catalysts. Among various metal candidates, transition/post-transition metals have attracted much attention due to its low-cost, low-toxicity, and intrinsic catalytic property for CO2 reduction. Since general electro-catalysis is highly correlated with mass diffusion, crystal orientation, surface area, etc., manipulating the catalyst structure is an effective method to improve catalytic performance. Here, nanostructured Sn, Bi, and Zn electrodes as electrocatalysts for CO2 reduction to C1 products. The synthesized catalysts showed highly efficient CO2 reduction activity in terms of current density, Faradaic efficiency, and more importantly, stable performance. The coordinately unsaturated sites derived from the nanostructured metal catalysts can effectively stabilize the reaction intermediate by lowering the energy barrier for its binding to the site.