Electrocatalyst Design for Efficient CO_2 Conversion from Low- to High-Temperature Electrochemical Systems

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Electrochemical conversion of CO_2 is a key technology for carbon-neutral energy systems, yet its efficiency and stability strongly depend on electrode materials and reaction environments. In this talk, I will present two complementary studies on electrocatalyst design for efficient CO_2 conversion across low- and high-temperature electrochemical systems. First, I will discuss the role of zirconium incorporation in bismuth-based electrocatalysts for low-temperature CO_2 reduction, where Bi-ZrO_2 heterostructure modifies the local reaction environment and enhances selective formic acid production. Second, I will introduce an in-depth study of $CuFe_2O_4$ cathodes under solid oxide electrolysis with surface analysis technique such as low-energy ion scattering (LEIS), TOF-SIMS, focusing on surface evolution, phase stability, and electrochemical performance under high-temperature CO_2 electrolysis conditions. By comparing these systems, this talk highlights design principles for tailoring catalyst composition and interfaces to control CO_2 conversion efficiency.

[References]

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