Electrocatalytic Reduction of Gaseous CO_2 to CO on Sn/Cu-Nanofiber-Based Gas Diffusion Electrodes

Abstract

Earth-abundant Sn/Cu catalysts are highly selective for the electrocatalytic reduction of CO_2 to CO in aqueous electrolyte. However, CO_2 mass transport limitations, resulting from the low solubility of CO_2 in water, so far limit the CO partial current density to about 10 $mA \cdot cm^{-2}$. To enhance CO_2 mass transport, we develop a process to fabricate Sn/Cu-coated polymer nanofiber networks, and demonstrate the materials as gas diffusion electrodes (GDEs) for electrochemically converting gaseous CO_2 to CO. The Sn/Cu-coated PVDF (Sn/Cu-PVDF) nanofiber GDEs achieve CO faradaic efficiencies (FEs) above 80 %, and maintain high CO partial current densities of up to 104 $mA \cdot cm^{-2}$. The Sn/Cu-PVDF GDE remains highly stable in an extended operation at -1.0 V for 135 hours, with an average FE for CO of > 85 %. These results represent an important step towards an economically viable pathway to CO_2RR.