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Title: Ag-induced Phase Transition of Bi₂O₃ Nanofibers for Enhanced Energy Conversion Efficiency towards Formate in CO₂ Electroreduction

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Abstract: Bi-based electrocatalysts have been widely investigated in the CO2 reduction reaction (CO2RR) for the formation of formate. However, it remains a challenge to achieve high Faradaic efficiency (FE) and industrial current densities at low overpotentials for obtaining both high formate productivity and energy efficiency (EE). Herein, we report an Ag-Bi2O3 hybrid nanofiber (Ag-Bi2O3) for highly efficient electrochemical reduction of CO2 to formate. Ag-Bi2O3 exhibits a formate FE of >90% for current densities from -10 to -250 mA center dot cm(-2) and attains a yield rate of 11.7 mmol center dot s(-1) center dot m(-2) at -250 mA center dot cm(-2). Moreover, Ag-Bi2O3 increased the EE (52.7%) by nearly 10% compared to a Bi2O3 only counterpart. Structural characterization and in-situ Raman results suggest that the presence of Ag induced the conversion of Bi2O3 from a monoclinic phase (alpha-Bi2O3) to a metastable tetragonal phase (beta-Bi2O3) and accelerated the formation of active metallic Bi at low overpotentials (at > -0.3 V), which together contributes to the highly efficient formate formation.

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