A Novel Approach to Create a Stable and Cost-effective Anode Catalyst Structure in a Formic Acid Fuel Cells

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We demonstrate a new approach with the design of a stable and cost-effective PtBi anode catalyst for use in formic acid fuel cells. The PtBi catalyst was fabricated via three consecutive electrochemical steps consisting of (step 1) electrochemical oxidation of carbon paper to form an adequate catalyst support, (step 2) Pt electrodeposition, and (step 3) underpotential deposition (UPD) of Bi onto the as-prepared Pt. Controlled electrochemical oxidation of plain carbon paper resulted in a well-dispersed and thin Pt catalyst layer as well as alleviating mass transport of HCOOH in the membrane electrode assembly (MEA), which enabled us to reduce the amount of Pt loading and extend the range of the HCOOH concentration windows. In addition, underpotentially deposited Bi on only 0.5 $mgcm^{-2}$ Pt significantly enhanced power performance and long-term stability compared to commercially available PtRu or Pd catalysts even with 3 $mgcm^{-2}$.

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