Assessment of the Stability and Durability of Pt/C and AuPt/C Nanocatalysts in Proton Exchange Membrane Fuel Cells

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Proton exchange membrane fuel cells are a type of electrochemical energy conversion device that can potentially replace conventional energy sources in a wide range of applications because of their relatively high sustainability, conversion efficiency, and power density. However, their commercialization is inhibited by performance and affordability issues related to the platinum (Pt/C) electrocatalyst commonly used at both electrodes. Recent research addressing the high cost, poor stability, and slow reaction kinetics of Pt/C focuses on nanoengineering Pt-based nanoalloy catalysts. One such bimetallic nanocatalyst, AuPt/C, had previously shown promising results as a more efficient alternative to Pt/C. Comprehensive understanding of the stability of AuPt/C in actual fuel cells and its shelf life durability remains rather limited. This study aims to determine the stability and durability of the alloy catalyst by examining several membrane electrode assemblies (MEAs) composed of variations of AuPt/C that were aged for a period of five years. The changes in the electrocatalytic performances of each MEA was carefully analyzed. It was found that bimetallic nanocatalysts were not only more electrochemically active than Pt/C, but also more chemically and structurally stable. The results have provided new insights into the design of MEAs and nanoalloy catalysts for practical fuel cell applications.