One-Pot Synthesis of Intermetallic PtPb Nanocatalysts in Ordered, Large-Pore Mesoporous Carbon/Silica for Direct Formic Acid Fuel Cell Anodes

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This study describes the one-pot synthesis of well-dispersed intermetallic PtPb nanoparticles in an ordered, large-pore mesoporous carbon/silica composites by employing an amphiphilic diblock copolymer (poly(styrene-*b*-ethylene oxide), PS-*b*-PEO) assisted co-assembly of hydrophobic metal precursors and hydrophilic carbon and silica precursors; for use as an anode catalyst in direct formic acid fuel cells (DFAFCs). The final materials have a two-dimensional (2-D) hexagonal type structure with uniform and large pores (>30 nm), in which intermetallic PtPb nanocrystals are highly dispersed. The activity and stability of the resulting PtPb ordered intermetallic nanocrystals in large-pore OMCSs are compared with commercial Pt/carbon and Pd/carbon, and are found to be superior. Single cell performance was analyzed in order to demonstrate that the final catalysts can be practically applied in real fuel cells owing to the interconnected pores of the large-pore OMCSs.