Highly Durable Fuel Cell Catalysts Using Block Copolymer-Based Carbon Particles with Ultralow Pt Usages

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Minimizing the use of platinum (Pt) catalysts in proton exchange membrane fuel cells (PEMFC) is essential, considering its high price and scarcity. Herein, we demonstrate novel catalysts for PEMFCs with high mass activity and durability, in which block copolymer-based carbon particles are loaded with an ultra-small amount of Pt. The mass activity measured after 30,000 cycles of single cell tests was 0.81 A mg^{-1}_{Pt} at 0.9 V, which is the highest performance reported to date. The newly developed catalyst yielded nearly the same power density as that of the commercial Pt/C, even with 1/20 of Pt usage. We developed the new strategy in which carbon particles were prepared by carbonizing crosslinked domain of block copolymer particles, resulting in uniform mesoporous carbon particles with ~25 nm pores. When Pt was deposited, thin carbon shells were formed encapsulating PtFe nanoparticles, catalyzing oxygen reduction reaction efficiently with high durability.