

Preparation and Application of Shaped Platinum Nanoparticles for Electrocatalytic Reactions

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Various sizes of platinum dendrites were synthesized and conducted for oxygen reduction reaction (ORR). The dendrites showed a superior activity, selectivity, and durability compared to commercial catalyst for ORR. Furthermore, the membrane electrode assembly (MEA) fabricated with Pt dendrites using the catalyst-coated membrane (CCM) method. Dendrite Pt/C showed much higher mass activity at high potential region for ORR due to lower activation overpotential, but the cell performance was only slightly enhanced compared to commercial Pt/C at the high current density region. Moreover, Pt cubes with a catalytically clean surface were synthesized by direct nucleation and overgrowth on the carbon support without an aid of surface-capping agents. When the Pt precursor was reduced in the presence of the carbon support and an anchoring agent, nucleation occurred on the carbon surface, and the Pt nuclei formed on the carbon supports overgrew into cubic shapes. Cysteamine provides nucleating site, and also acts as shape-controlling agents. The in-situ cubic Pt/C showed a superior specific activity and long-term stability for ORR without any additional process for the organic removal.