

Large pore sized mesocellular carbon foam supporting high dispersions of Pd₃Pt₁ nanoparticles for methanol-tolerant oxygen reduction reaction

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Pd₃Pt₁ nanoparticles with methanol tolerance are supported on various carbon supports: mesocellular carbon foam (MSU-F-C), CMK-3, and Vulcan XC-72. The particle size of Pd₃Pt₁ (~5 nm) is larger than the pore size of CMK-3 (~3 nm), resulting in the agglomeration of Pd₃Pt₁ nanoparticles on the external surface of the CMK-3. The large pore size and high BET surface area (1084 m² g⁻¹) of MSU-F-C allows the easy formation of TPB phase and high dispersion of Pd₃Pt₁ nanoparticles, which is of great importance for a fuel cell catalyst support. Due to its highly dispersed state, Pd₃Pt₁/MSU-F-C shows the superior ORR activity than Pd₃Pt₁/Vulcan XC-72 and Pd₃Pt₁/CMK-3. Pd₃Pt₁/MSU-F-C is methanol tolerant at 400 rpm in the presence of 0.5 M CH₃OH, while methanol oxidation peaks are observed in the case of Pd₃Pt₁/Vulcan XC-72 and Pd₃Pt₁/CMK-3. The high methanol tolerance and high activity of the Pd₃Pt₁/MSU-F-C during an ORR suggests that it may be an economically viable candidate to become a cathode catalyst for a DMFC.