179a Performance of PEM Fuel Cell Electrodes Using Single Wall Carbon Nanotubes as Catalyst Support

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Single-wall carbon nanotubes (SWNT) show great potential for improvement of fuel cell electrodes performances. In particular, they have a high surface area that can stabilize high Pt dispersions, they can increase the electronic conductivity of the electrodes and also improve the gas transport rate through the electrodes reactive layers. SWNT-supported electrocatalysts were prepared by a proprietary method in which, by adjusting the pretreatment conditions and the pH of a SWNT dispersion, we can select the appropriate surface charge to favor anion or cation exchange with a Platinum precursor salt. In this way we have demonstrated that high loadings (20-30 wt%) of Pt with high dispersions (Pt nanoparticle sizes as low as 1-2 nm) could be achieved. These novel electrocatalysts have been physically characterized by EXAFS, XPS and TEM. The electrocatalytic activity was demonstrated by cyclic voltammetry.
Different methods have been used for the preparation of PEM Fuel Cell electrodes, mainly: 1) coating of catalyst ink on gas diffusion layer (GDL); 2) coating of catalyst ink directly over proton-exchange membrane and 3) using transfer decals (thin-film decal method) to apply catalyst ink over the membrane by hotpressing. A series of 5 cm2 membrane-electrode assemblies have been prepared and their performance was tested at different temperatures, pressures and humidification levels by using a Fuel Cell Test Station. Findings from this study indicate that the behaviour of the SWNT-based fuel cell electrodes is strongly related to the preparation method used, with the highest performance observed in the case of the thin-film decal method.