

Preparation and Characterization of CO-Tolerant Electrocatalyst for PEM Fuel Cell

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Abstract : Important requirements for the anode side electrocatalysts of polymer electrolyte membrane (PEM) fuel cells are CO-tolerance, stability and corrosion resistance. Carbon is still the most common material for electrocatalyst supports due to its low cost, high electrical conductivity and high surface area, which can ensure good dispersion of the Pt. However, carbon becomes degraded at higher potentials and it causes problem during application. Therefore it is important to explore alternative materials with improved stability. Molybdenum-oxide can improve the CO-tolerance of the Pt/C catalysts, but it is prone to leach in acidic electrolyte. The Mo was stabilized by isovalent substitution of molybdenum into the rutile phase titanium-dioxide lattice, achieved by a modified multistep sol-gel synthesis method optimized for preparation of Ti_{0.7}Mo_{0.3}O₂-C composite. High degree of Mo incorporation into the rutile lattice was developed. The conductivity and corrosion resistance across the anticipated potential/pH window was ensured by mixed oxide - activated carbon composite. Platinum loading was carried out using NaBH₄ and ethylene glycol; platinum content was 40 wt%. The electrocatalyst was characterized by both material investigating methods (i.e. XRD, TEM, EDS, XPS techniques) and electrochemical methods (cyclic-voltammetry, COads stripping voltammetry, hydrogen oxidation reaction on rotating disc electrode). The electrochemical activity of the sample was compared to commercial 40 wt% Pt/C (Quintech) and PtRu/C (Quintech, Pt= 20 wt%, Ru= 10 wt%) references. Enhanced CO tolerance of the electrocatalyst prepared using the Ti_{0.7}Mo_{0.3}O₂-C composite material was evidenced by the appearance of a CO-oxidation related 'pre-peak' and by the pronounced shift of the maximum of the main CO oxidation peak towards less positive potential compared to Pt/C. Fuel cell polarization measurements were also carried out using Bio-Logic and Paxitech FCT-150S test device. All details on the design, preparation, characterization and testing by both electrochemical measurements and fuel cell test device of electrocatalyst supported on Ti_{0.7}Mo_{0.3}O₂-C composite material will be presented and discussed.

Keywords : anode electrocatalyst, composite material, CO-tolerance, TiMoOx

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