Incorporation of TiO₂ into the PtPd/C Catalyst Layer for Improvement ORR Activity and Water Management

Nutthaphak Kitiphatpiboon¹, Mali Hunsom^{1,2,*}

¹ Fuels Research Center, Department of Chemical Technology, Faculty of Science, Chulalongkorn University, 254 Phayathai Road, Bangkok 10330, Thailand.

² Center of Excellence on Petrochemical and Materials Technology (PETRO-MAT), Chulalongkorn University, 254 Phayathai Road, Bangkok 10330, Thailand

*E-mail: mali.h@chula.ac.th

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Titanium dioxide (TiO₂) samples prepared by different thermal treatments were incorporated in the cathode catalyst layer of a polymer electrolyte membrane or proton exchange membrane (PEM) fuel cell. Increasing the TiO₂ treatment temperature (500–800 °C for 3 h) resulted in an increased rutile phase content and crystal size, but decreased textural properties of the obtained TiO₂. Incorporation of TiO₂ prepared at the appropriate temperature in the carbon-supported PtPd catalyst (PtPd/C) layer positively affected the catalyst dispersion, electrochemical surface area and electrical conductivity of catalyst layer, but did not affect the electron pathway of the oxygen reduction reaction (ORR) of PtPd/C catalysts. Overall, the PtPd/C catalyst with TiO₂ calcined at 800 °C (T₈₀₀-PtPd/C) exhibited the highest ORR activity (~486 mA/cm² at 0.6 V) both in an acid solution and in a PEM fuel cell under a H₂/O₂ environment at atmospheric pressure compared to those for the Pt/C, PtPd/C and the other TiO₂-PtPd/C catalysts.

Keywords: TiO₂, PtPd/C catalyst; ORR activity; PEM fuel cell

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