Paper ID: A363

High Conductivity of Novel $Ti_{0.9}Ir_{0.1}O_2$ Support for Pt as a Promising Catalyst for Low-Temperature Fuel Cell Applications

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EXTENDED ABSTRACT

The demand of robust and efficient catalyst for low temperature fuel cells has emerged in recent years to replace unstable commercial Pt/C catalyst. Here, Novel nanostructured $Ti_{0.9}Ir_{0.1}O_2$ was synthesized and utilized as a catalyst support for Pt. The novel $Ti_{0.9}Ir_{0.1}O_2$ support is synthesized by a facile synthetic route via low-temperature hydrothermal process with once step without using any surfactant and/or stabilizer as well as further heating treatment after preparation. Interestingly, $Ti_{0.9}Ir_{0.1}O_2$ being mainly of anatase phase possessed a uniform morphology of spherical nanoparticles with nanoparticle size of 10-20 nm. More importantly, the $Ti_{0.9}Ir_{0.1}O_2$ support with low content of Ir doped into the TiO_2, however, it possesses very good conductivity ($1.6\ 10^{-2}$ S/cm) that enhance 10^5 times compared to undoped TiO_2 (10^{-7} S/cm) and also much higher than that of the conductivity value of non-carbon support of previous work. The small Pt particle sizes over $Ti_{0.9}Ir_{0.1}O_2$ support was homogeneously found to be 3-4nm could be resulted from the intrinsic strong support interaction with Pt and high crystallinity and conductivity of support. As a result, the cyclic voltammogram indicated that Pt/$Ti_{0.9}Ir_{0.1}O_2$ exhibited high electrochemically specific surface area (ECSA) of 78.91 m^2g^{-1}Pt, which was much higher than that of commercial Pt/C catalyst (49.09 $m^2.g^{-1}$Pt). These results indicate that the Pt/$Ti_{0.9}Ir_{0.1}O_2$ catalyst with extremely low content of iridium in $Ti_{0.9}Ir_{0.1}O_2$ but it possesses the good properties of catalyst that could be used as a novel catalyst for fuel cell application that can be enhance the activity and stability of traditional Pt/C catalyst.

Keywords**:** $Ti_{0.9}Ir_{0.1}O_2$, Iridium doped TiO_2, non-carbon catalyst supports.