Enhanced Catalytic Oxygen Reduction Performance from Titania Supported PtPb Nanoparticles

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Stable and long-term electrocatalytic performance towards cathodic oxygen reduction reaction (ORR) was achieved by impregnation of PtPb nanoparticles (NPs) on anatase titania (TiO2) support. Organometallic precursors, H2PtCl6.6H2O and Pb(CH3COO)2 and TiO2 supports were mixed in anhydrous methanol and then co-reduced using sodium borohydride. Finely dispersed PtPb NPs with the average particle size between 2 and 4 nm were achieved through wet-chemical synthetic route. PtPb/TiO2 showed superior catalytic activity both in terms of onset potential as well as cathodic current density than that of Pt/TiO2 towards ORR. The onset potential and cathodic current density of PtPb/TiO2 was 0.60 V and -0.89 mA mg⁻¹ at 0.2 V. Whereas, the onset potential and cathodic current density of Pt/TiO2 was 0.43 V and 0.17 mA mg⁻¹ at 0.2 V. Both onset potential and cathodic current density were not altered over 50 cycles in the case of PtPb/TiO2, however, greatly altered in the case of Pt/VC. The leaching of Pb from PtPb NPs dispersed on TiO2 was greatly suppressed than that of TiO2-free or Vulcan carbon (VC) supported PtPb. Impregnation of PtPb on TiO2 can be the practical cathodic electrode catalytic materials for fuel cells in terms of its stable, enhanced catalytic performance, and leaching tolerance.