High Performance Carbon-Supported IrRu Alloy Catalyst for the Hydrogen Oxidation Reaction in an Alkaline Anion-Exchange Membrane Fuel Cell

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The alkaline anion-exchange membrane fuel cell (AAEMFC) is characterized by excellent efficiency due to the low reaction activation energy of its cathode. However, the slow hydrogen oxidation reaction (HOR) at the anode degrades its performance. Herein, to improve the HOR kinetics, carbon-supported IrRu of varying compositions are prepared using the polyol process. According to spectroscopic analyses, the IrRu catalysts exhibit strong electronic interactions between Ir and Ru. In particular, before and after the accelerated stress stability cycles, the HOR activities of $IrRu_2$/C are 2.4 and 3.8 times higher than that of the commercial Pt/C catalyst, respectively. Therefore, these results demonstrate the excellent HOR activity and catalytic stability of $IrRu_2$/C. The membrane electrode assembly tests conducted to validate the catalytic effect reveal that the performance (800 mA cm^{-2}) of $IrRu_2$/C as an anode catalyst is 4.1 times higher than that of Pt/C (195 mA cm^{-2}) at 0.6 V. The $IrRu_2$/C catalyst proposed in this study is a suitable replacement for the Pt/C catalyst and an excellent HOR catalyst for cost-effective AAEMFC applications.