Preparation of Pt and PtRu Nanocatalysts Support on Carbon Black N115 for Proton Exchange Membrane Fuel Cell (PEMFC)

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ABSTRACT

In this work, carbon N115-supported Pt and Pt-Ru nanoparticles were prepared by a simple microwave-assisted solution method using ethylene glycol as both a reducing agent and solvent. By microwave radiation, Pt and Pt-Ru solution can be reduced by ethylene glycol and become Pt metal or Pt-Ru alloy support on carbon. Depending on these procedures Pt/C and Pt-Ru/C nanocatalysts were obtained. The particle size of Pt/C catalysts was measured to be about 2.50-3.00 nm and Pt-Ru/C catalysts was about 1.50-2.00 nm. Pt/C catalysts dispersed more homogeneously on carbon supporter than Pt-Ru/C catalysts. The catalyst products were characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), and transmission electron microscopy (TEM) techniques.

Key words: Pt and PtRu supported on carbon catalysts, Microwave-assisted solution method, Proton exchange membrane fuel cell (PEMFC)

INTRODUCTION

In these recent years, there has been a considerable interest in the development of renewable energy to solve the energy shortage problem. Pollution produced by the consumption of petroleum oil is a consequence that needs to be urgently considered. Because of the advantage of zero emission, a fuel cell, especially Proton Exchange Membrane Fuel Cell (PEMFC) was introduced in order to reduce the consumption of petroleum oil and the air pollution. PEMFC is an energy source that can operate whenever we supply the fuel to it. By feeding hydrogen gas at the anode and oxygen gas at the cathode with the assistance of appropriate catalysts, fuel cell can generate energy in the electric form without any air pollution. The reactions at anode, cathode and overall of PEMFC are

anode: $H_2 \rightarrow 2H^+ + 2e^-$ (1)

cathode: $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$ (2)

overall: $2H_2 + O_2 \rightarrow 2H_2O + \text{heat}$ (3)

The electrochemical performance of fuel cell depends on the properties of the catalysts. In general, the catalyst is prepared as nanometer size of noble metal