

**A Investigation of Oxygen Reduction Reaction in Gas
Diffusion Electrode for PEM Fuel Cell by Ac-Impedance
Analysis**

교류 임피던스 분석을 통한 PEM 연료전지 공기극에서의
산소 환원반응에 관한 연구

이성재 · 변수일

한국과학기술원 신소재공학과

Oxygen reduction reaction in gas diffusion electrode for proton exchange membrane(PEM) fuel cell was investigated in 1 M H₂SO₄ solution by using ac-impedance spectroscopy. For this purpose, the Pt/C catalyst slurry was coated on one side of the Nafion membrane by screen printing method and then it was hot-pressed at 195 °C for 2 min under 77 bar. The measured ac-impedance spectra consisted of a straight line inclined at constant angle to the real axis in the high-frequency range, one arc in the intermediate-frequency range and one inductive loop in the low-frequency range, which are associated with the diffusion limitation within the active catalyst layer, the charge transfer reaction on the Pt nanoparticle and the relaxation of the adsorbed intermediate species, respectively. From the occurrence of the low-frequency inductive arc, it was suggested that oxygen reduction reaction proceeds via formation of intermediate states in the gas diffusion electrode. On the basis of the experimental results, it was concluded that the oxygen reduction reaction proceeds through the three consecutive reaction, i.e. an ECE mechanism, and the first one-electron transfer reaction is the rate determining step. In addition, the effects of the temperature and oxygen partial pressure on the kinetic parameters governing oxygen reduction reaction in the gas diffusion electrode were discussed in detail.

Reference

1. S.-I. Pyun and Y.-G. Ryu, J. Power Sources, 62 (1996) 1.