펄스 전기환원법을 이용한 고분자 전해질 연료전지용 저담지 전극의 제조

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Preparation of Low Loading Platinum Catalyst Electrodes Using Current Pulse Electrodeposition

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Key words : PEMFC, catalyst layer, pulse electrodeposition, low loading, catalyst utilization efficiency

Abstract : The polymer electrolyte membrane fuel cell (PEMFC) is regarded as highly attractive for mobile as well as stationary applications due to its high power density at temperatures of 60~100 ℃and its compact cell design. In recent years, research and development in fuel cells have been accelerated, but at present, the cost of fuel cell systems is still too high to become viable commercial products. Especially, platinum which is most widely used fuel cell catalyst is rare and very expensive hence reducing its loading without losing performance has always been a major goal. There have been many reports dealing with the construction of the platinum electrodes in dispersed form on various carbon supports. Nanoscaled platinum particles have usually been synthesized by impregnation method or colloidal method. Recently electrodeposition technique has gained momentum and there has been a significant number of reports on the syntheses of such nanosized platinum electrocatalysts.

Low Pt loading catalyst electrodes have been prepared by current pulse electrodeposition. By localizing platinum particles on the surface of carbon electrode containing a desired amount of ion conductor(Nafion), it is possible to decrease the thickness of the catalyst layer and increase the catalyst utilization efficiency. This method consists of a two-step procedure involving the construction of carbon layer including Nafion, followed by a galvanostatic platinum deposition on the preformed carbon layer. The performance of membrane electrode assemblies employing these electrodes (0.015 mg Pt cm^{-2} on the anode) has shown similar values compared with that of high catalyst loading electrodes (0.15 mg Pt cm^{-2} on both electrodes) fabricated by conventional method. TEM was used to investigate the dispersion of the platinum particles. Platinum loadings were determined quantitatively by ICP-AES.

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