슈퍼커패시터를 위한 그래핀 기반 전극의 전기화학적 특성에 대한 카본블랙 도입의 효과

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Influence of carbon black on electrochemical performance of graphene-based electrode for supercapacitor

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In this work, graphene was prepared by modified Hummers method and prepared graphene was applied to electrode materials for supercapacitor. In addition, to enhance the electrochemical performance of graphene, carbon black was deposited onto graphene via chemical reduction. The effect of the carbon black content incorporated on the electrochemical properties of the graphene-based electrodes was investigated. It was found that nano-scaled carbon black aggregates were deposited and dispersed onto the graphene by the chemical reduction of acid treated carbon black and graphite oxide. From the cyclic voltammograms, carbon black-deposited graphene (CB-GR) showed improved electrochemical performance, i.e., current density, quicker response, and better specific capacitance than that of pristine graphene. This indicates that the carbon black deposited onto graphene served as an conductive materials between graphene layers, leading to reducing the contact resistance of graphene and resulted in the increase of the charge transfer between graphene layers by bridge effect.

Key words : Graphene(그래핀), Carbon black(카본블랙), Chemical reduction(화학적 환원), Electrochemical performance (전기화학적 특성)

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The effects of Nafion® ionomer content in dual catalyst layer on the performances of PEMFC MEAs

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In order to achieve high performance and low cost for commercial applications, the development of membrane electrode assemblies (MEA), in which the electrochemical reactions actually occur, must be optimized. Expensive platinum is currently used as an electrochemical catalyst due to its high activity. Although various platinum alloys and non-platinum catalysts are under development, their stabilities and catalytic activities, especially in terms of the oxygen reduction (ORR), render them currently unsuitable for practical use. Therefore, it is important to decrease platinum loading by optimizing the catalysts and electrode microstructure. In this study, we prepared several different MEAs (non-uniform Nafion® ionomer loading electrode) which have dual catalyst layers to find the optimal Nafion® ionomer distribution in the electrodes. We changed Nafion® ionomer content in the layers to find the ideal composition of the binder and Pt/C in the electrode. For MEAs with various ionomer contents in the anodes and cathodes, the electrochemical activity (activation overpotential) and the mass transport properties (concentration overpotential) were analyzed and correlated with the single cell performance. The dual catalyst layers MEA showed higher cell performance than uniformly fabricated MEA, especially at the high current density region.

Key words : Polymer electrolyte membrane fuel cell(PEMFC, 고분자 전해질막 연료전지), MEA(막전극 접합체), Nafion® ionomer(나피온 이오노머), Dual catalyst layer, Catalyst coated membrane(CCM)

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