Quaternary PtRuFeCo nanoparticles supported N-doped graphene as an efficient bifunctional electrocatalyst for low-temperature fuel cells

황승규, Muruganantham Rethinasabapathy, 강성민, 허윤석†
인하대학교
(yunsuk.huh@inha.ac.kr†)

In this study, N-doped graphene supported quaternary electrocatalyst (PtRuFeCo/NG) was synthesized and evaluated for potential oxygen reduction reaction (ORR) and methanol oxidation reaction (MOR) in low-temperature fuel cells. The PtRuFeCo/NG catalyst exhibited excellent electrocatalytic activity towards MOR and ORR. The maximum power densities achieved with direct methanol fuel cell (DMFC) and proton exchange membrane fuel cell (PEMFC) were 778 and 122 mW cm^{-2}, respectively. Also, PtRuFeCo/NG showed 2- to 3-fold enhancement in MOR, ORR, PEMFC and DMFC performances than that of the previously reported commercial and multi-metallic catalysts due to doping of nitrogen into the graphene matrix in addition to the bifunctional, electronic and integrated synergistic effects of alloying low-cost Fe and Co with Pt and Ru. The PtRuFeCo/NG has high potential to be used as anode and cathode catalysts with great reduction in the processing cost of fuel cell which is the major problem facing the fuel cell industry.