Nitrogen Doped Graphene Sheets for Electrochemical Oxygen Reduction

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Development of low cost electrodes is a key issue for the commercialization of PEMFCs, particularly given that platinum, presently considered the most effective catalyst, is expensive and in limited supply. Accordingly, there is strong motivation to replace platinum with a low cost material such as palladium alloys, metalloporphyrins, or N doped carbon. Carbon materials have been used in PEMFCs because of their high surface area, good electric conductivity, and high chemical stability. Research on graphene has been motivated by its superior electrical properties. This 2-dimensional crystal of sp_2 hybridized carbon has a 2-dimensional electron system that exhibits exciting electronic properties. Recently, application to electrochemical catalysts has been studied. Graphene showed fast electron-transfer kinetics and high catalytic activity for oxygen reduction in alkaline media. However, the electrochemical properties of graphene have thus far not been widely studied. N doped graphene were prepared via exfoliated graphite oxide. This graphene exhibited significantly high oxygen reduction activity. High electric conductivity, high surface area, large amount of edge sites and pyridinic N site in rGS (reduced graphene sheets) contribute to the high ORR activity. The rGS showed a potential to replace expensive Pt for oxygen reduction reaction in PEMFC.