Preparation of Graphene Oxide-silver Electrodes by Electrophoretic Deposition and Its Catalytic Performance for Oxygen Reduction

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Abstract: Graphene oxide (GO) nanosheets were exfoliated from Graphite Oxide in 1-Methyl-2-pyrrolidinone (NMP), and silver nitrate was added, then GO was charged by the silver ions. GO nanosheets were deposited on glassy carbon (GC) electrode by electrophoretic deposition (EPD), the silver ions were electrochemically reduced to silver particles, uniformly dispersed in the GO nanosheets. The modified electrode’s morphology and microstructure were characterized by AFM, SEM, Raman, XRD and elemental mapping. The catalytic behavior during oxygen reduction on the modified electrodes was studied in alkaline medium. This research revealed that the onset potential of oxygen reduction on the GO+Ag electrode shifted to the positive direction by 255mV compared with the GC electrode; the reduction current density on the GO+Ag electrode was found to be 8.900mA cm$^{-2}$, which is 4.1 times as that of the GC electrode. Using the LSV curves recorded at different rotation rates to construct Koutechy-Levich plots, the electron numbers showed that the oxygen reduction reaction proceeds on GO+Ag electrode was the 4e$^{-}$ reaction pathway.

Key words: electrophoretic deposition; graphene oxide; silver; oxygen reduction