Novel binder-free Ag@Ni(OH)$_2$ over graphene/Ni foam and glucose sensing

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Graphene combining with metal nanoparticles or other compounds is widely recognized to be a viable strategy to assemble high-activity catalysts. Unique properties of high conductivity and transparency, 2D morphology, and high stability in acid and alkaline solutions make graphene an excellent electron transfer medium on the interface of graphene/active materials as catalysts. Among them, graphene/metal nanoparticle (G/MNP) composites have been attracting more interest because of remarkably enhanced catalytic property, which is ascribed to a synergic effect from the interface of graphene and active sites. In general, reducing agents and electrodeposition methods have been employed to *in-situ* reduce metal ions such as Au^{3+}, Pt^{4+}, Ag^{+}, and Cu^{2+} (M^{x+}) to MNPs on the graphene to form G/MNP composites. In this study, graphene is grown on nickel foam (NF) by chemical vapor deposition (CVD), which is directly used for MNP deposition. Different from bare NF, special phenomenon is observed that the graphene-coated nickel foam (GNF) composite can greatly speed up the electrodeless reduction of M^{x+} ions on the surface of the graphene. Interestingly, the MNP deposition and Ni(OH)$_2$ nanosheet assembly simultaneously occur on the GNF. Binder-free Ni(OH)$_2$-wrapped Ag hybrid developed on the GNF (Ag@Ni(OH)$_2$-GNF) is found to serve as an efficient electrochemical sensor because of its unique structure. A low detection limit of 0.3 μM and high sensitivity are achieved for the glucose detection, which confirms that the hierarchical electrode structure of Ag@Ni(OH)$_2$-GNF composite is highly effective to have extensive applications.