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A COMPOSITE OF MNO2 COATED WITH GRAPHENE BY GALVANOSTATIC ELECTRODEPOSITION AND ITS HIGHLY ACTIVE AND STABLE CATALYSIS FOR OXYGEN REDUCTION REACTION

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The development of efficient, low-cost and stable electrocatalysts as the alternative to platinum for the oxygen reduction reaction (ORR) plays key roles in several important energy storage and conversion technologies such as fuel cells, metal-air batteries. Manganese oxides (MnOx) have been widely investigated as a promising non-precious catalyst for ORR because of its abundance, low cost, environmental friendliness. Nevertheless, the practical applications of these materials are greatly impeded by its lower energetic efficiencies which is primarily ascribed to their poor conductivity and relatively lower amount of catalytically active sites. Moreover, MnOx catalysts are prone to aggregate in recycling use which may further decrease the ORR catalytic activity and stability. Herein, a composite consisting of spherical MnO2 coated with reduced graphene oxide (MnO2@RGO) has been prepared by step galvanostatic electrodeposition (Figure 1). Firstly, MnO2 is deposited on the electrode surface by anodic galvanostatic method by the following process Mn2++ $2H_2O$—>MnOOH + e^- + $3H^+$—>MnO^2 + $4H^+$ + 2e-. And then a three-dimensional composite of reduced graphene oxide (RGO) coating MnO_2 is obtained through cathodic galvanostatic reduction of GO to RGO. The formed core-shell structure not only prevent graphene sheets from damage caused by pressure of MnOx on the surface of graphene which may thereby maximizing the catalyst conductivity extremely, but also reduce the agglomeration of MnOx particles. In addition, owing to the larger specific surface area of graphene on the outer layer and its stronger electron-donating ability than MnO_2, the asprepared composite is easier to adsorb and activate O_2. To the best of our knowledge, few research reports have been involved on the galvanostatic preparation of MnO_2-graphene core-shell composite and its application for ORR hitherto.

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