Long Range Electron Transfer over Graphene-based Catalyst for High Performing Oxygen Reduction Reactions: Importance of Size, N-doping, and Metallic Impurities

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N-doped carbon materialsare considered as next-generation oxygen reduction reaction (ORR) catalysts forfuel cells due to prolonged stability and low cost. However, the underlyingmechanism of these catalysts is barely identified, preventing the rationaldesign of high performing catalysts. Here, we show that the first electron istransferred into O_2 molecules at the outer Helmholtz plane (ET-OHP)over a long range. Based on the ET-OHP mechanism, the location of the electrode potential dominantly characterizes the ORR activity.