

B-doped graphene quantum dots and graphene hydrogel composites for Zn-air battery and water electrolysis

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Herein, a facile one-step hydrothermal route has been demonstrated to synthesis the novel all carbon based composites (GH-BGQD) of boron-doped graphene quantum dots (B-GQDs) anchored on graphene hydrogel (GH). The obtained GH-BGQD has the unique 3D architecture with high porosity and large specific surface area, possessing the abundant catalytic active centers of B-GQDs and the enhanced mass transport of electrolyte and ion diffusion by highly conductive 3D structured GH. The GH-BGQD composites exhibit a superior trifunctional electrocatalytic activity toward oxygen reduction reaction (ORR), oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) with an excellent long-term stability and durability, which is comparable to the commercial Pt/C and Ir/C catalyst. Based on excellent trifunctional electrocatalytic activities, the Zn-air battery and water electrolysis fabricated with GH-BGQD exhibit an efficient and durable performance. This work provides a new strategy of designing an efficient carbon based multifunctional electrocatalyst for the electrochemical energy devices.