Boron-doped grapheme quantum dots decorated on reduced graphene as a highly efficient metal-free electrocatalyst toward oxygen reduction

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A simple and cost effective hydrothermal approach for synthesis of boron-doped graphene quantum dots (BGQDs) has been demonstrated in presence of boric acid and glucose. X-ray photoelectron spectroscopy (XPS) and Fourier transform infrared (FTIR) spectroscopy characterizations reveal that boron atoms are successfully introduced into quantum dots structures with atomic percentage up to 3.65%. The BGQDs with average size of 4.5 nm are uniformly anchored on reduced graphene oxide (rGO) sheets through 2-steps hydrothermal and thermal treatment. The composite of BGQDs and rGO possesses excellent electrocatalytic with improving long-term stability and methanol tolerance. Interestingly, electrocatalytic activity can be comparable to the available commercial Pt/C. The integration of BGQD and rGO could induce synergistic contribution of good electron transfer from high conductive graphene and rich catalytically active sites of BGQDs These results demonstrate that rGO-BGQD hybrid materials is a promising materials for metal-free oxygen reduction reaction (ORR) catalyst in fuel cells as well as other electrochemical applications.