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Heteroatom-Doped Carbon Quantum Dots as Electrocatalysts for the Oxygen Reduction Reaction

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Abstract

The oxygen reduction reaction (ORR) is one of the most fascinating electrochemical reactions, especially for applications in alkaline fuel cells and metal-air batteries. Over the last few years, research steadily shifted towards anion exchange membrane fuel cells (AEMFC) that can perform without noble metal catalysts at the cathode with the perspective of a significant reduction of cost and use of strategic rare metals. The 4-electron ORR can be written in alkaline conditions:

$$O_2(g) + 4\ e^- + 2\ H_2O \rightarrow 4\ OH^- \qquad E° = 0.40\ V \qquad (1)$$

In this work, we investigate metal-free catalysts based on heteroatom-doped carbon quantum dots (CQD) synthesized by a hydrothermal method from inexpensive and non-toxic precursors [1] and including anion-exchange ionomers. Ionomers contribute to lower aggregation of CQD and increase the catalytic activity by fast transport of OH^- ions. We have examined the catalytic behavior of CQD for the ORR in alkaline conditions with various methods of electrode preparation, such as drop-casting and electrospinning [2].

References

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