Effect of the Surface Chemistry of Hydrothermal Carbons on the Oxygen Reduction Reaction

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Abstract (250 words máx)

In the last decades, researchers have focused on developing new innovative materials to enhance the performance of environmentally friendly energy conversion devices. In this context, fuel cells are considered an interesting alternative towards greener electrical energy conversion due to their high efficiency and low emission of pollutants. However, the overall reaction is limited by the oxygen reduction reaction (ORR) due to its sluggish kinetics. The most commonly used electrocatalysts to supply faster kinetics are platinum-based materials which are costly and may be responsible for up to 50% of the total cost of a fuel cell. Therefore, the development of new low-cost electrode materials is essential to make fuel cells more affordable. Activated carbons (ACs) can be obtained from abundant, low-cost and environmental-friendly sources, such as biomass, which makes them good candidates to replace Pt-based electrocatalysts. Nonetheless, the physicochemical properties of ACs need to be modified to achieve outstanding electrochemical performance. These modifications can be achieved by adequate functionalization with nitrogen and the incorporation of M-N_4 (M=Metal) groups. In this work, different strategies to introduce iron and nitrogen functionalities into the structure of hydrothermal carbons have been evaluated. The appropriate combination of nitrogen functionalities and iron state resulted in materials with an enhanced electrochemical performance towards ORR.