Synthesis Metal-free Nitrogen-doped Porous Carbon by Removing Al from Al-MOFs as an Efficient Electrocatalyst for Oxygen Reduction Reaction

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Exploring cheap and stable electrocatalyst for the oxygen reduction reaction (ORR) is now an important issue for the large-scale application of fuel cells. Herein, we have demonstrated a facile synthesis of Nitrogen-doped porous carbons (NPC-MILs) for oxygen reduction reaction by using an amine functionalized Al-MOFs (NH₂-MIL-53(Al)) as the precursor with both nitrogen source and carbon source. NPC-MILs as metal-free electrocatalysts are demonstrated promising potential for ORR. The optimized NPC-MIL-900 (carbonized at 900 °C) exhibits a likeness four-electron process and its ORR catalytic activity can be comparable to commercial Pt/C. Furthermore, chronoamperometric measurement shows that only 13% loss at the current density is occurred after 40000 s, whereas the corresponding current density loss at the Pt/C (20wt%) is as high as 31%. Chronoamperometric responses also show the NPC-MIL-900 catalyst has higher resistance to methanol in alkaline electrolyte than Pt/C. Those indicate that the NPC-MIL-900 has potential application in fuel cells.

Keywords: electrocatalyst, metal-free, oxygen reduction reaction, N-doped microporous carbon material, metal-organic framework

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