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Metal-organic frameworks derived platinum-cobalt bimetallic nanoparticles in nitrogen-doped hollow porous carbon capsules as a highly active and durable catalyst for oxygen reduction reaction

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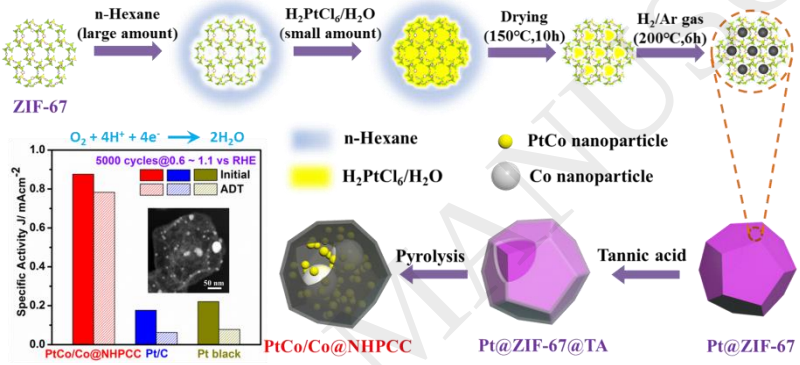
Graphical Abstract



Highlights

- • A new efficient method utilizing MOFs is developed to synthesize PtCo alloys.
- • Fine PtCo alloys within nitrogen-doped hollow porous carbon capsules are obtained.
- • The sample displays outstanding catalytic activity in oxygen reduction reaction
- • The sample exhibits excellent catalytic durability and stability.

Abstract

Pt-based nanomaterials are regarded as the most efficient electrocatalysts for the oxygen reduction reaction (ORR) in proton exchange membrane fuel cells (PEMFCs). However, widespread adoption of PEMFCs requires solutions to major challenges encountered with ORR catalysts, namely high cost, sluggish kinetics, and low durability. Herein, a new efficient method utilizing Co-based metal-organic frameworks is developed to produce PtCo bimetallic nanoparticles embedded in unique nitrogen-doped hollow porous carbon capsules. The obtained catalyst demonstrates an outstanding ORR performance, with a mass activity that is 5.5 and 13.5 times greater than that of commercial Pt/C and Pt black, respectively. Most importantly, the product exhibits dramatically improved durability in terms of both electrochemically active surface area (ECAS) and mass activity compared to commercial Pt/C and Pt black catalysts. The remarkable ORR performance demonstrated here can be attributed