# Synthesis of hollow Co/Fe-N-C spheres from MOF/polypyrrole core-shell particles and their application for oxygen reduction reaction

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Oxidation-reduction reaction (ORR) is one of the key reactions for fuel cells which should be improved for higher performance. Currently, a lot of approaches have been tried to improve the efficiency of the ORR, and MOF-derived electrocatalysts are getting more attention due to their tunable pore structure and easy functionalization. Herein, we fabricate Fe and Co-codoped hollow carbon spheres, which was prepared on the hybrid PPy-Ps spheres as hard templates. PPy is used as a source for nitrogen-doping as well as a carbon source for the catalyst. Sodium sulfate is a surfactant that increases the electronegativity of PPy, which plays a pivotal role in the growth of ZnCoBZIF layer evenly on the entire sphere's surface. After a single pyrolysis step, Co and Fe species were embedded in the hollow carbon spheres. The catalysts were characterized by field emission scanning electron microscope, field emission transmission electron microscope, X-ray diffraction, Brunauer–Emmett–Teller analysis, and X-ray photoelectron spectroscopy. Morphological control combined with transition metal and high nitrogen atom concentrations from PPy and ZIFs yield excellent ORR performance.