Hybrid catalysts derived from zeolitic imidazolate framework for rechargeable Zn–air batteries

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In this study, carbon nanotube-grafted, Co-Fe embedded, nitrogen-doped porous carbon nano-framework (CNT-Co-Fe/NC) was synthesized for oxygen reduction reaction (ORR), and CNT-CoS_2-Fe/NC formed by the carbonization of Fe-doped ZIF67/ZIF8, and vulcanization was for oxygen evolution reaction (OER). Both electrocatalysts show excellent performances in terms of onset potential, half-wave potential, and limited current compared to the commercial Pt/carbon (ORR) and RuO_2 (OER) electrocatalysts. The Zn-air battery (ZAB) study was conducted with the hybrid catalyst of 50 wt% CNT-Co-Fe/NC and 50 wt% CNT-CoS_2-Fe/NC in the cathode, while a hybrid catalyst of 50 wt% Pt/C + 50 wt% RuO_2 was used as the benchmark. The results showed that outstanding cycle stability of over 1800 cycles (300 hrs) at 10 mA/cm^2 with very good retention of 95% and a very small potential gap of 0.68 V can be achieved in comparison to that of the hybrid catalyst of Pt/C + RuO_2 (i.e., 215.3 mW/cm^2, 803.7 mAh/g, 900 cycles: retention 92 %, potential gap 0.837 V for 150 hrs). It is believed that the novel hybrid catalyst is of great potential for the rechargeable ZAB.