

# Mesoporous carbon catalyst for cathode in non-aqueous electrolyte based Li-O<sub>2</sub> battery

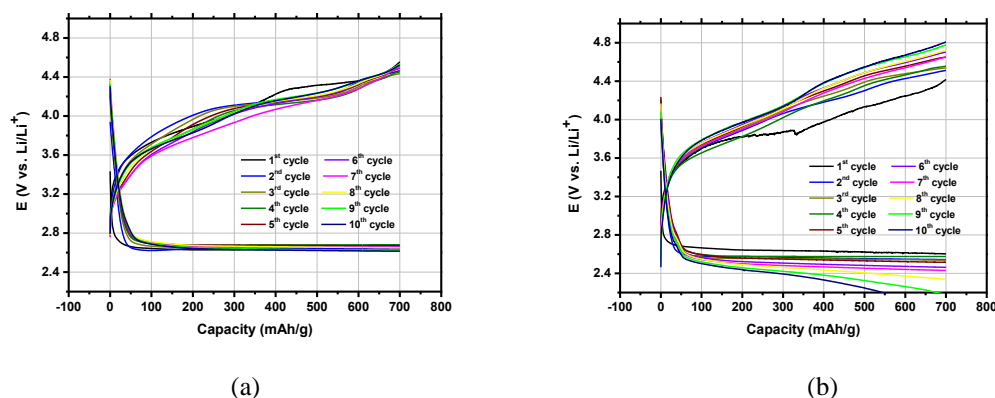
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The rechargeable Li-O<sub>2</sub> battery represents an attractive energy storage device for various applications because of its theoretical energy storage capacity is 5~10 times higher than that of Li-ion batteries. However, Li-O<sub>2</sub> battery has a few problems in commercial applications, for example, the large overpotential during charge-discharge process, cyclability, and rate capability. Since the lithium anode has very little polarization, most of all, the large overpotential during the cell charge-discharge process is mainly caused by the cathode. Thus, it is important to use a suitable electrocatalyst in order to reduce the overpotential that effectively can help the oxygen evolution reaction and oxygen reduction reaction in the cathode. Especially, the structure of the carbon material used in the air electrode is critical factor that affects the electrochemical performance of Li-O<sub>2</sub> batteries for decreased overpotential during charge-discharge process. The insoluble discharge products will be accumulated inside the pores of the porous electrode and will eventually clog the oxygen diffusion path inside the electrode [1]. Therefore, the cyclability and cell potential of a Li-O<sub>2</sub> battery is determined by the carbon air electrode [1].

In this work, we synthesized mesoporous carbon, CMK-3, and CMK-3 loaded with iron and cobalt binary oxide, FeO/CoO/CMK-3, nanoparticles as cathode catalysts for Li-O<sub>2</sub> batteries. CMK-3 has a good electrochemical performance due to the high electroactive surface area, and the unique arrangement of ordered and interconnected pores, which can provide effective gas diffusion channels [2]. The crystallinity and surface morphologies were measured by XRD (x-ray diffraction), SEM (scanning electron microscopy), and FE-TEM (field emission transmission electron microscopy). The electrochemical cell performance was based on Swagelok-type cell. It was assembled in argon-filled glove box in which the moisture and oxygen concentration were less than 1 ppm. Swagelok-type Li-O<sub>2</sub> cell is composed of a lithium metal anode, impregnated non-aqueous electrolyte, such as 1 M LiTFSI (lithium bis(trifluoromethanesulfonyl)imide) in TEGDME (tetraethylene glycol dimethyl ether), into a glass fiber separator, and a catalyzed porous air-cathode. Cut-off capacity of charge-discharge cycles was conducted at 700 mAh/g to investigate cycle stability, reversible capacity, and plateau voltage. The constant current discharge and charge cycle test was conducted at 0.2 mg/cm<sup>2</sup>(157 mA/g). The mesoporous FeO/CoO/CMK-3 catalyst exhibited excellent capacity retention in non-aqueous electrolytes, when compared with bare CMK-3, and carbon black supported CoO/FeO catalysts.



**Figure 1.** Charge-discharge voltage profiles of (a) FeO/CoO/CMK-3, and (b) FeO/CoO/C catalysts.

## References

- [1] J. Xiao, J. Wang, X. Li, J. Liu, D. Geng, J. Yang, Y. Li, L. Sun, J. Electrochem. Soc., **157**, A487 (2010)
- [2] B. Sun, H. Liu, H. Ahn, G. Wang, Nano Res., **5**, 460 (2012)