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Novel Nanostructured Materials for zinc-air and Li-Air Batteries

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This talk will focus on the design and synthesis of nanostructured non-precious metal-based hybrid catalysts for Zn-air and Li-air batteries. The presentation will describe some our works in nanostructured hybrid bifunctional electrocatalysts as air electrode for Zn-air rechargeable batteries, as well as nanostructured porous perovskite and spinel metal oxide catalytic materials as air electrode for Li-air batteries.

In this presentation, I will introduce the fundamental and the most recent and significant scientific progresses made in the fields relevant to Zn-air and Li-air batteries, with emphasis placed on air electrodes. The preparation of MnO_2 nanotubes functionalized with Co_3O_4 nanoparticles and their use as bifunctional air cathode catalysts for oxygen reduction reaction and oxygen evolution reaction in rechargeable zinc-air batteries will be reported. These hybrid MnO_2/Co_3O_4 nanomaterials exhibit enhanced catalytic reactivity toward oxygen evolution reaction in alkaline conditions compared with that in the presence of MnO_2 nanotubes or Co_3O_4 nanoparticles alone. Other bifunctional catalysts for oxygen reduction and evolution reactions in Zn-air batteries include spinel $MnCo_2O_4$/ nanocarbon hybrids, perovskite lanthanum cobalt manganese oxides/nanocarbon hybrids (LCMO/NC), Co_3O_4 nanoparticles decorated carbon nanofiber and cobalt sulphide/N- or S-doped grapheme etc. I also will report porous cobalt-manganese oxide nanocubes derived from metal organic frameworks and porous perovskite $LaNiO_3$ nanocubes as cathode catalysts for rechargeable Li-O_2 batteries.

Keywords: nanostructured materials; bifunctional electrocatalysts; Zn-air batteries; Li-air batteries