

## A Chemically and Electrochemically Bifunctional Mobile Catalyst for Anti-aging Lithium-Oxygen Batteries

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Aprotic lithium-oxygen batteries (LOBs) have been considered as the high-energy-density alternative to replace currently available lithium ion batteries. Highly reactive superoxide as the discharge intermediate of LOBs triggers side reactions to deteriorate LOB performances. Also, high overpotential is required to oxidize the discharge product  $\text{Li}_2\text{O}_2$  during charge due to the non-conductive nature of  $\text{Li}_2\text{O}_2$ . Herein, we present 4-carboxy-TEMPO as a bifunctional mobile catalyst soluble in electrolytes for improving LOB performances. The roles of 4-carboxy-TEMPO is two-fold: (1) the chemo-catalyst to catalyze superoxide disproportionation reaction for suppressing the superoxide-triggered side reactions during discharge; and (2) the redox mediator to oxidize  $\text{Li}_2\text{O}_2$  in a kinetically effective way for reducing the overpotential during charge. The use of the mobile catalyst in LOB cells resulted in the 4-fold increase in cycle life from 50 cycles to 200 cycles as well as the 4-fold increase in the discharge capacity, significantly reducing the overpotential during charge.