

# Seed Catalyst Enable Enhanced Cyclability on Deep (Dis)Charge in Aprotic Li-O<sub>2</sub> Batteries

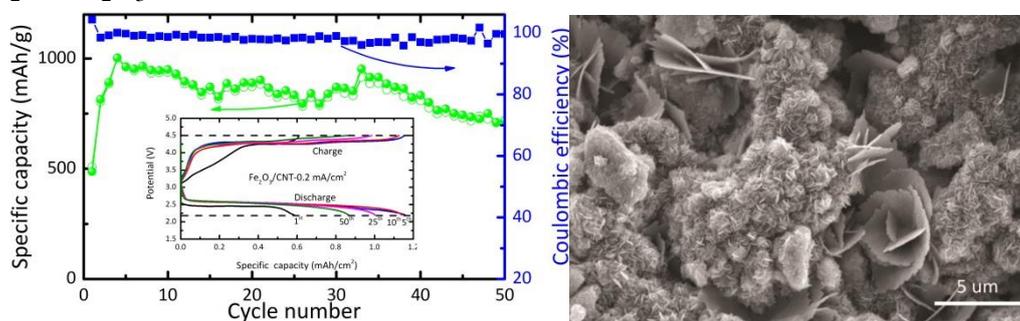
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Rechargeable Li–O<sub>2</sub> batteries, as a promising energy conversion system have been widely investigated owing to its extraordinary specific energy. However, due to the formation of insulating Li<sub>2</sub>O<sub>2</sub> during the oxygen reaction process, Li–O<sub>2</sub> batteries perform poor cyclability and large charge overpotential which limits the delivery of a high reversible energy density.<sup>1</sup> Efforts are trying to find catalyst that can provide a stable oxygen cathode and catalytic a low charge overpotential for Li–O<sub>2</sub> batteries. Various metal and metal oxide combined with carbon cathode have been developed to improve the cycling performance of this battery system. Unfortunately, almost all of these used catalysts (except for some noble metal Au<sup>2</sup> and RuO<sub>2</sub><sup>3</sup> materials) performed the improving cycling ability is based on capacity limited cycling, rather than potential limited cycling. That makes it difficult to quantify if improved cycling stability can be attributed to the specific role of electrode or to the continuous consumption of new active sites on the electrode surface is delivered.

In this work, we present a cheap nano seed Fe<sub>2</sub>O<sub>3</sub> catalyst combined with carbon nanotubes (CNT) as a oxygen diffusion cathode in a aprotic Li–O<sub>2</sub> battery to achieve impressive cycle stability, high coulombic efficiency and large capacity when cycled deeply with potential restriction (left picture). By using Fe<sub>2</sub>O<sub>3</sub> nano seed particles, more isotropic Li<sub>2</sub>O<sub>2</sub> crystallites are formed, resulting in smaller secondary particles (right picture) with high specific surface area and shorter electron conduction pathways, which is deduced responsible for the improvement of the cycling ability of the battery. In addition, due to the almost equivalent d-spacing's of the (104) and (100) reflections in Fe<sub>2</sub>O<sub>3</sub> and Li<sub>2</sub>O<sub>2</sub> respectively, an epitaxial “*epitaxially induced nucleation and growth*” mechanism has been hypothesized for the growth of Li<sub>2</sub>O<sub>2</sub> on Fe<sub>2</sub>O<sub>3</sub> nano seeds.



## References

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