

Pt nanoparticle deposited α -MnO₂ nanotube: A higher active electrocatalyst for Li–O₂ batteries

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As an advanced large-scale energy storage and conversion system, rechargeable non-aqueous Li–O₂ battery has recently attracted considerable attention because of its high gravimetric and volumetric energy density^[1-3]. One of the critical challenges that limit the practical application of Li–O₂ battery is the huge polarization during charging process. It is reported that the charging process is catalytically sensitive, and the charging efficiency could be improved by adding catalytic materials. The catalyst not only can decrease the charge overpotential, but also improve the cycle ability of the cell^[4]. Many materials have been employed as the cathode catalysts, such as noble metal (Pt, Au, Pd), metal alloys to carbons and transition-metal oxides^[5]. Although it is proved that noble metal shows the most active for oxygen evolution reaction (OER), its high cost limits the practical use of Li–O₂ battery.

Herein, α -MnO₂ nanotubes and Pt nanoparticle deposited α -MnO₂ nanotubes as cathode catalysts of Li–O₂ batteries have been synthesized in this work. The obtained materials were characterized by XRD, Raman, SEM, XPS and BET technologies. The electrochemical performances of prepared catalysts were tested by tracking the decomposition of Li₂O₂ after 15 h charging of Li₂O₂-based electrode in Li–O₂ batteries using transmission X-ray diffraction. SEM indicated that Pt nanoparticles were deposited uniformly outside and inside of the α -MnO₂ nanotubes (Fig. 1). The performance of 10 wt% Pt deposited α -MnO₂ nanotube shows the similar with that of pure Pt (Table 1). Compared with the pure α -MnO₂ nanotubes, 10 wt% Pt deposited samples show much better catalytic performance on the decomposition of Li₂O₂ during OER (Table 1), which could be attributed to the high surface area, optimal crystalline morphology and surface state modification. Our findings provide insight into the catalytic mechanisms during OER and the design of catalyst-promoted electrodes for Li–O₂ batteries.

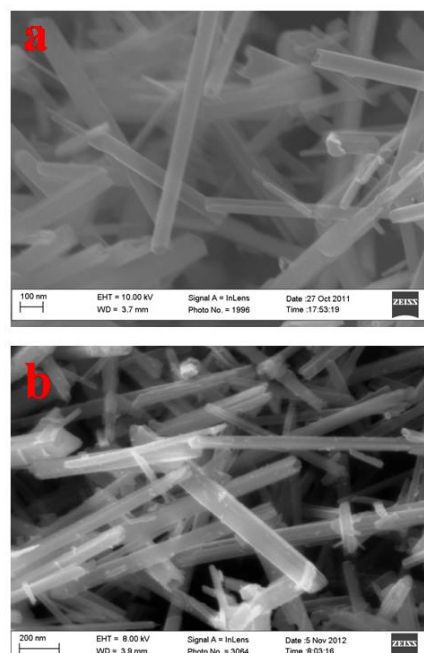


Figure 1. SEM images for: (a) α -MnO₂ nanotubes, and (b) 10 wt%Pt deposited α -MnO₂ nanotubes

Table 1. The residual ratio of Li₂O₂ after 15 h charging in electrodes with different catalysts

	α -MnO ₂ nanotube	Pt/ α -MnO ₂ nanotube	Pt
Residual ratio of Li ₂ O ₂ (%)	89.03	58.73	55.37

Reference:

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