

Electronic Supplementary Information

In situ formed Pd nanolayer as a bifunctional catalyst for Li-air battery in ambient or simulated air

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Experimental details

Synthesis of Pd nanolayer

In a typical synthesis, Ni foam (800 mg) was firstly immersed into a 10 ml HF/alcohol solution ($v/v = 2/3$) for 5 min. After the surface etch, 250 ml PdCl₂ (Energy Chemical, 99 % purity) alcohol solution (0.0003 M) was rapidly added under vigorous stirring. The resulting mixture was maintained for 30 min at room temperature until the solution color changed from reddish to greenish. Then the obtained foam was washed fifth with alcohol, dried at 200°C for 12 h, and characterized by X-ray diffraction (XRD, DX-2600), field-emission scanning electron microscopy/energy-dispersive spectrometry (FESEM/EDS, JSM-7500F) and transmission electron microscopy/selected area electron diffraction (TEM/SAED, Tecnai G2 20 S-TWIN).

Li-air cell assembly

O₂ cathodes were prepared by pasting the mixture of Super P carbon (SP, 70 wt. %) and PTFE (30 wt. %) onto the obtained Pd@Ni foams or the pristine Ni foams and drying at 120°C overnight. The typical carbon load of the cathodes is 1~1.5 mg. Swagelok-type Li-air batteries were assembled inside an Ar-filled glove box. In each cell, a Li foil was used as the anode and separated by a celgard 2500 membrane, and the electrolyte is 100 μ l 0.65 M lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) in tetraethylene glycol dimethyl ether (TEGDME). The electrolyte was purchased from Beijing Institute of Chemical Reagents. The batteries were tested in three kinds of atmosphere: pure O₂ (1 atm), O₂/N₂ mixture ($v/v = 21/79$, 1 atm) and ambient air (0.945 atm, $RH = 70\%$). When the batteries was tested in ambient air, no protection from moisture and CO₂ was applied. The galvanostatic cycling was carried out on Land Batteries Testing System (Wuhan Land Electronic Co. Ltd.). The current density was 0.1 mA cm⁻² and the potential range is from 2 to 4.5 V. Linear scan voltammetry (LSV) was recorded using Par2273 potentiostat at a scan rate of 0.5 mV s⁻¹.

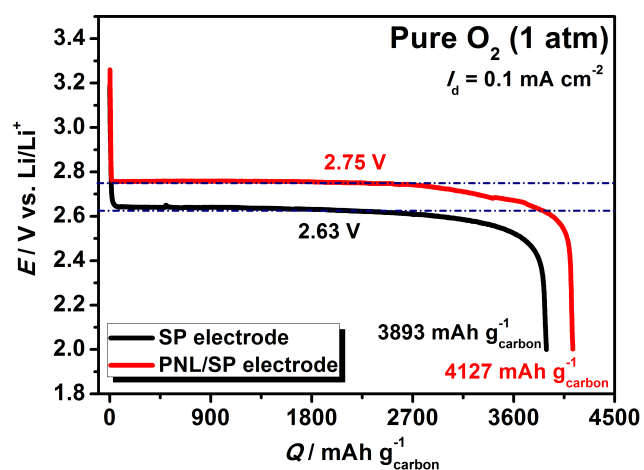


Fig. S1 The first discharge curves of Li-air battery with or without PNL incorporation in pure O_2 .