Supporting Information for

Mesoporous NiO Nanosheet Networks as High Performance Anode for Li-Ion Battery

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Experiments details

Fabrication procedure: The mesoporous NiO nanosheet networks (NSNs) were grown on Ni foam *via* a solvothermal method and a subsequent calcination. All chemical reagents utilized in the present study were of analytical grade without further purification. A typical synthesis for porous NiO NSNs on Ni foam was performed as follows. Ni foam (100 PPI pore size, 380 g m^{-2} surface density, and 1.5 mm thick) was sonicated in absolute ethanol for 30 min, and then placed vertically into a Teflon-lined autoclave of 40 mL capacity. 0.349 g Ni(NO$_3$)$_2$·6H$_2$O was dissolved in absolute ethanol to form a 35 mL solution. The solution was transferred into the autoclave. The autoclave was sealed and maintained at 135 °C for 12 h, then cooled to room temperature naturally. The Ni foam with the grown mesoporous NiO NSNs on it was rinsed with absolute ethanol and then heated in a tube furnace at 400 °C for 3 h in a vacuum environment.

The mass of the active NiO material was estimated by using a reduction method. Ni foam with NiO NSNs was reduced under purified hydrogen at 400 °C for 3 h. The mass of the NiO

on Ni foam before and after reduction was weighed by a microbalance (Mettler, XS105DU) with an accuracy of 0.01 mg. According to the reaction of $NiO + H_2 \rightarrow Ni + H_2O$, the active weight of NiO (m_{NiO}) is derived from $m_{NiO} = \Delta m \times 74.69/16$, where Δm is the weight difference of the Ni foam before and after reduction reaction. The mass loading is ~1. 32 mg cm^{-2} in average.

Structural Characterization: The structure and morphology of the NiO NSNs were characterized by X-ray powder diffraction (XRD, Rigaku D/Max-2400 with Cu K_α radiation), field-emission scanning electron microscopy (SEM, Hitachi, S-4800), and transmission electron microscope (TEM, FEI, Tecnai G^2 F30).

Electrochemical Characterization: Electrochemical characterizations were carried out using CR-2032 type coin cell, which was assembled in a high-purity argon filled glove box ($H_2O <$ 0.5 ppm, $O_2 <$ 0.5 ppm, MBraun, Unilab) by using the NiO NSN electrode as the working electrode and Li foil as the counter and reference electrode. Celgard 2320 was used as the separator membrane. The electrolyte was 1 M lithium hexafluorophosphate ($LiPF_6$) dissolved in ethylene carbonate: dimethyl carbonate: ethyl methyl carbonate in a 1:1:1 volume ratio. The galvanostatic discharge-charge cycling and cyclic voltammetry were carried out at room temperature by using a multichannel battery tester (Neware, BTS-610) and an electrochemical workstation (CHI, 660C), respectively.
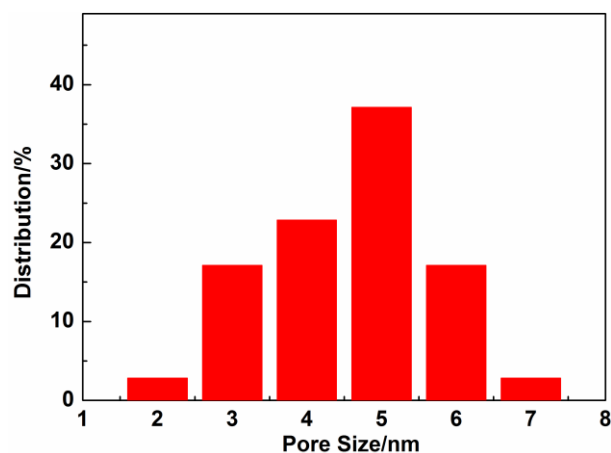
Supplementary figures

Fig. S1 The pore size distribution of mesoporous NiO nanosheets. The main pores center around 5 nm.
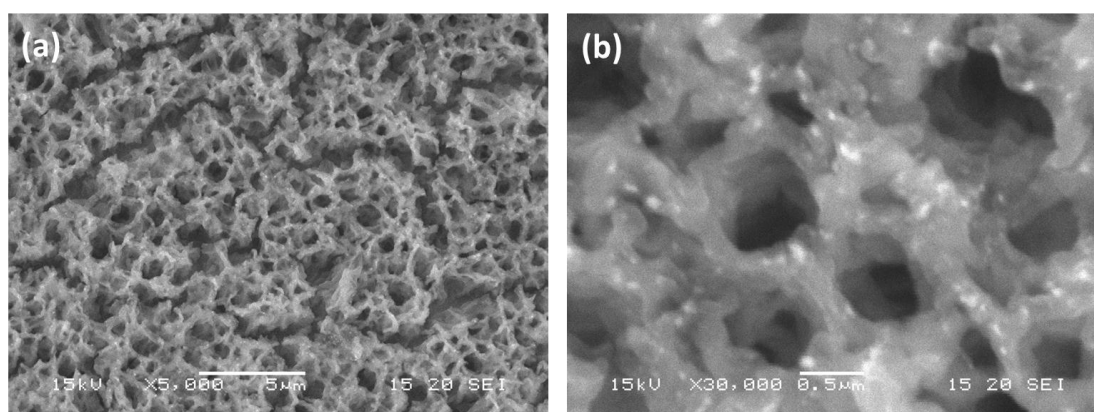

Fig. S2 SEM images of the mesoporous NiO nanosheet network electrode after 20 cycles at 0.2 C. The electrodes can still maintain its network as well as macroporous structrues after charging the cell back, suggesting that it has a high stability. Furthermore, the thickness of the nanosheets increases from 10 nm to around 200 nm, which may attribute to the SEI formation.