

Electronic Supplementary Information (ESI)

Porous NiO architecture prepared with coordination polymer precursor as high performance anode material for Li-ion batteries

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Experimental details

Materials and methods

1,4-benzenedicarboxylic acid (H₂bdc), isonicotinic acid (Hina), Ni(NO₃)₂·6H₂O, NaOH and the solvents used in CP preparation and electrochemical tests were all of analytical grade, and obtained from Aladdin Industrial Inc. (Shanghai, P.R. China). Acetylene black (>99.9%) and polyvinylidene fluoride (PVDF, >97%) and *N*-methyl-2-pyrrolidone (NMP, >99%) were supplied by J&K Scientific Ltd. (Beijing, P.R. China). Scanning electron microscope (SEM) images were taken with a JEOL JSM-7500F scanning electron microscope. Transmission electron microscopy (TEM) images were obtained with JEM-2010FEF transmission electron microscope operating at 200 kV. Powder X-ray diffraction (PXRD) was performed on a Rigaku D/max-2500 diffractometer with Cu K α radiation ($\lambda = 0.15406$ nm) at 40 kV and 100 mA. N₂ adsorption-desorption isotherm measurement was operated on a V-Sorb 2800P surface area and pore size analyser, and the sample was pretreated at 150 °C for 180 min. Fourier transform infrared spectroscopy (FT-IR) was measured by a MAGNA-560 Fourier transform infrared spectrometer with nujol mull method. Elemental analysis (C, H, and N) was carried out on a Perkin-Elmer 240C analyzer. Thermogravimetric analysis (TGA) was performed on a Rigaku standard TG-DTA analyzer from ambient temperature to 700 °C with a heating rate of 10 °C min⁻¹ in the air, and an empty Al₂O₃ crucible was used as the reference.

Synthesis of porous NiO

In a typical procedure, 0.1 mmol H₂bdc and 0.2 mmol Hina were dissolved in 10 mL of the mixture of H₂O and DMF (1:1, v/v) containing 0.4 mmol NaOH. Under vigorous stirring, 0.4 mmol Ni(NO₃)₂·6H₂O was added into this solution. The suspension was transferred to a Teflon-lined stainless steel autoclave and heated at 120 °C for 3 h. The pale green precipitate was separated by centrifugation, washed several times with ethanol, dried at 60 °C for 6 h and used as the precursor. The calcination process was carried out at 450 °C for 2 h in air to decompose the precursor to porous NiO.

Electrochemical measurement

The electrochemical measurement of the as-prepared NiO sample was performed on a CR2016-type coin cell. A slurry was prepared by thoroughly mixing porous NiO, acetylene black (added to enhance the conductivity of the electrode) and PVDF at a weight ratio of 60:20:20 in NMP solution. This slurry was uniformly spread onto a Cu foil substrate and dried in a vacuum oven at 120 °C for 12 h to fabricate the working electrode, which contained active material of 1.9 mg cm⁻². The test cells was assembled in an Ar-filled glove box using Li metal as the counter electrode, celgard 2300 membrane as the separator and 1 M LiPF₆ solution (ethylene carbonate:dimethyl carbonate = 1:1 in volume) as the electrolyte. The discharge-charge test was performed in the voltage range of 0.01–3.0 V at different current densities on battery testing system (C2001A, 5 V, 1 mA). Cyclic voltammetry (CV) was carried out on a LK3200 electrochemical workstation over the potential range of 0.01–3.0 V at a scan rate of 0.1 mV s⁻¹.

Table S1 The cycle performance of the NiO materials reported in recent years (2012–present)

Entry	Morphology	Current density (mA g⁻¹)	Cycle number	Capacity (mA h g⁻¹)	Ref.
1	Yolk-shell	700	150	821–951	1
2	Fiber	40	50	638–696	2
3	Fiber	80	100	583–784	3
4	Nanotube	200	100	600–620	4
5	Nanowall array	500	50	564–723	5
6	Microsphere	200	30	380–975	6
7	Nanotube array	2000	10000	629–675	7
8	Spherical nanoparticle	Not given	50	144–145	8
9	Flower-like architecture	359	40	~1000	This work

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