Supplementary Information for

Mesoporous $\beta$–Ni(OH)$_2$: synthesis and enhanced electrochemical performance

Baojun Li, Man Ai and Zheng Xu*

State Key Laboratory of Coordination Chemistry and Nanjing National Laboratory of Microstructure, Department of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210093, P. R. China
*Corresponding author. E-mail: zhengxu@netra.nju.edu.cn

Scheme S1 The synthesis of mesoporous $\beta$–Ni(OH)$_2$ assisted by CTAB. ●: CTAB micelles

Fig. S1 SEM images of mesoporous $\beta$–Ni(OH)$_2$ (a, b: Ni(OH)$_2$–1 and c, d: Ni(OH)$_2$–2).

Fig. S2 TEM images of mesoporous $\beta$–Ni(OH)$_2$ (a: Ni(OH)$_2$–1 and b, c: Ni(OH)$_2$–2).

Fig. S3 FTIR spectrum of (a) CTAB, (b–d) samples of $\beta$–Ni(OH)$_2$ containing CTAB obtained at various time, and (e) pure mesoporous $\beta$–Ni(OH)$_2$.

Experimental

Reagents. Nickel nitrate, sodium hydroxide, Cetyl trimethyl ammonium bromide (CTAB), and ethanol were analytical purity reagents obtained from commercial resources and used without further purification.

Characterization of mesoporous $\beta$-Ni(OH)$_2$. X-ray diffraction patterns were recorded on a Panalytical X’pert Pro powder diffraction system using Cu K$_\alpha$ radiation (Ni filter, $\lambda=0.15418$ nm, 40 kV and 40 mA) in the range $10^\circ \leq 2\theta \leq 80^\circ$. The scanning electron microscopy (SEM) images were taken with a JEOL JSM 5610 LV apparatus. Transmission electron microscopy (TEM) images were obtained on a JEOL JEM–2010 instrument at an acceleration voltage of 200 kV. Fourier transform infrared (FTIR) spectra were recorded on a Bruker Vector 22 spectrometer. Raman spectrum was recorded on a Renishaw RM–1000 with excitation from the 514.5 nm line of an Ar–ion laser with a power of about 5 mW. N$_2$ adsorption–desorption was tested on ASAP 2020 (Micromeritics, USA). Thermal analysis proceeded on SETERAM TG–DTA/DSC thermal analyzer. Cyclic voltammogram tests were conducted on Shanghai Chenhua CHI660 electrochemical workstation. Three-electrode system was adapted and the electrolyte was KOH (6 M, containing 15 gL$^{-1}$ LiOH). The scan range was $-0.05$–$0.55$ V, and the scan rate was 5 mV S$^{-1}$. Hg/HgO electrode was as reference electrode, Pt electrode was the counter electrode, and mesoporous Ni(OH)$_2$–1 was the active material of working electrode. Battery performance was determined on the LAND battery testing system Shenzhen Liuwei Technology Co., Ltd.. Using mesoporous $\beta$–Ni(OH)$_2$ as the working electrode, foam nickel as the counter electrode and Hg/HgO electrode as reference electrode. The working electrode is composed of active material, carbon, and PTFE with ratio $m_A:m_C:m_{PTFE}=80:15:5$. The electrolyte was KOH (6 M, containing 15 gL$^{-1}$ LiOH) and the weight of $\beta$–Ni(OH)$_2$ in the working electrode was used to estimate the discharge capacity of the battery.
Scheme S1 The synthesis of mesoporous $\beta$-Ni(OH)$_2$ assisted by CTAB. ●: CTAB micelles

Fig. S1 SEM images of mesoporous $\beta$-Ni(OH)$_2$ (a, b: Ni(OH)$_2$–1 and c, d: Ni(OH)$_2$–2).
Fig. S2 TEM images of mesoporous β–Ni(OH)$_2$ (a: Ni(OH)$_2$–1 and b, c: Ni(OH)$_2$–2).

Fig. S3 FTIR spectrum of (a) CTAB, (b–d) samples of β–Ni(OH)$_2$ containing CTAB obtained at various time, and (e) pure mesoporous β–Ni(OH)$_2$. 