Supplementary Information

PVP-assisted construction of $Co_3V_2O_8$@NiCo LDH hierarchical structure for high-performance lithium-ion batteries

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Characterization materials

Morphologies and structure of $Co_3V_2O_8$@NiCo LDH, $Co_3V_2O_8$ and NiCo LDH. NiCo LDH were characterized by field-emission scanning electron microscopy (FESEM, Hitachi S-4800) and high-resolution TEM (HRTEM, JEOL, JEM-2100). The functional groups of products were performed on Fourier transform infrared (FTIR spectrum Bruker Vertex 70). The crystal structure of samples was conducted by powder X-ray diffraction (PXRD, Bruker D8 advance diffractometer, Cu Kα radiation, λ=0.15405 nm). The elemental mapping and chemical composition were investigated by energy-dispersive X-ray spectroscope (EDX) attached to the FESEM. The elemental valence was detected by X-ray photoelectron spectroscopy (XPS, ESCALAB 250 Xi) from Thermo Fisher Scientific.

Electrochemical measurements

The lithium storage performance was evaluated by 2032-type cells. The lithium foil was regarded as counter electrode and Celgard 2300 as the separator. 1 M $LiPF_6$ in ethylene carbonate (EC)/ethyl methyl carbonate (EMC)/dimethyl carbonate (DMC) (v:v:v = 1:1:1). The working electrode was prepared by mixing active materials (60 wt %), carbon black (30 wt %) and polyvinylidene fluoride (PVDF, 10 wt %) in N-methyl pyrrolidone (NMP). slurry of mixture was pasted onto Copper foil and dried at 80 ^oC in vacuum oven for 12 h. The average mass loading of active materials was ~0.6 mg cm^{-2}. All cells were assembled in a glove box filled with argon. Cyclic voltammetry (CV) curves were tested by electrochemical workstation (CHI760D, Chenhua, China) within 0.01~3 V. Galvanostatic charge-discharge cycles were performed on battery testing system (Land CT2001A, Wuhan, China) with the voltage range of 0.01~3 V. Electrochemical impedance spectroscopy (EIS) were characterized by Zahner Elektrik electrochemical workstation within the frequency range of 0.01 Hz~100 kHz under open circuit voltage.

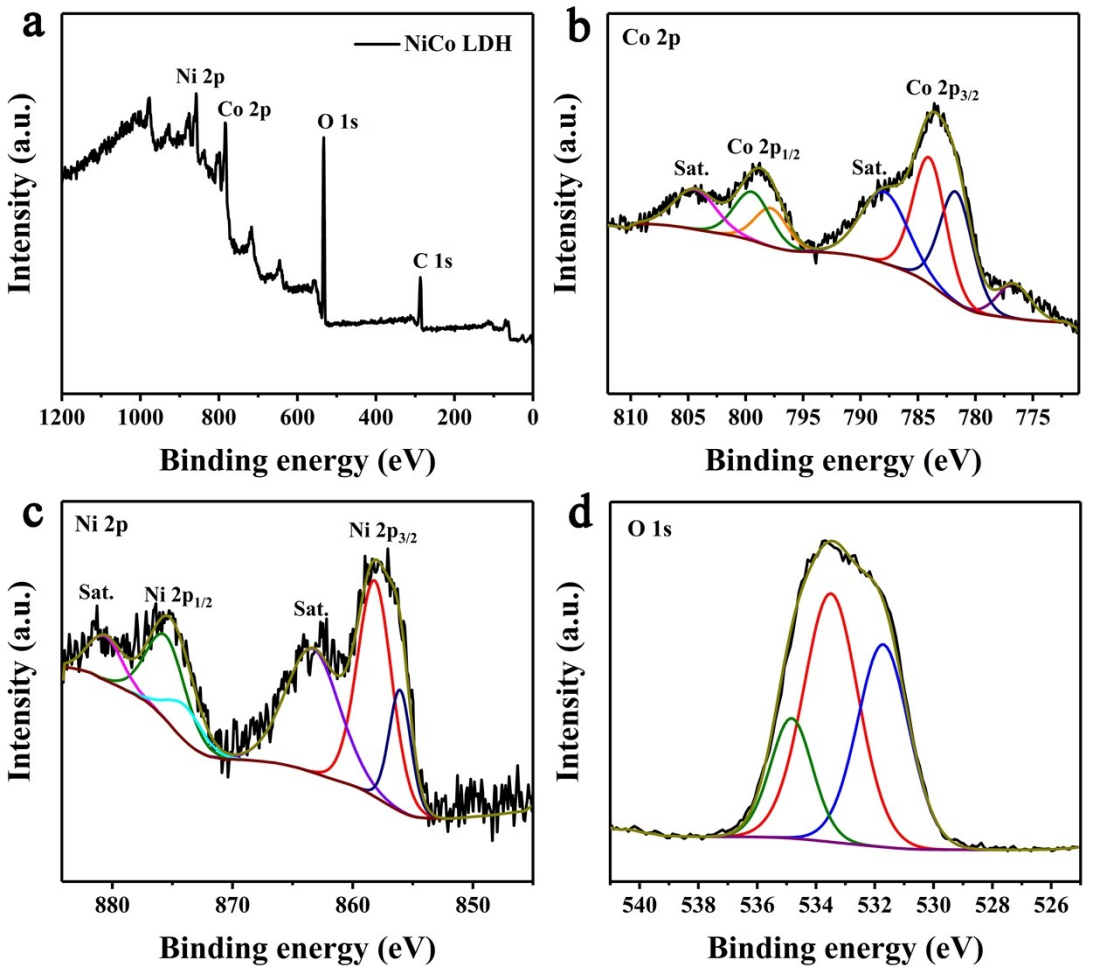

Figure S1. The XPS spectra of NiCo LDH: survey spectra (a), Co 2p (b), Ni 2p (c), O 1s (d)

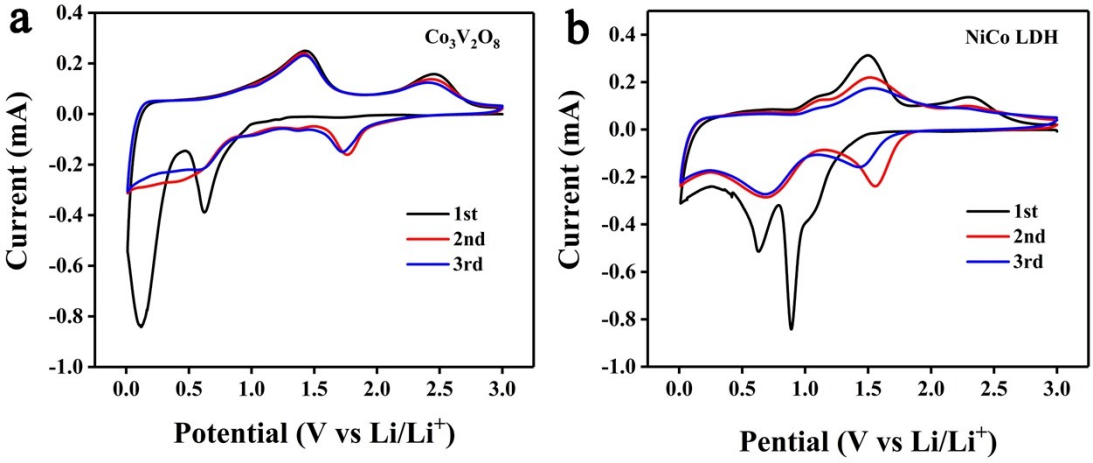

Figure S2. CV profiles of $Co_3V_2O_8$ (a) and NiCo LDH (b)

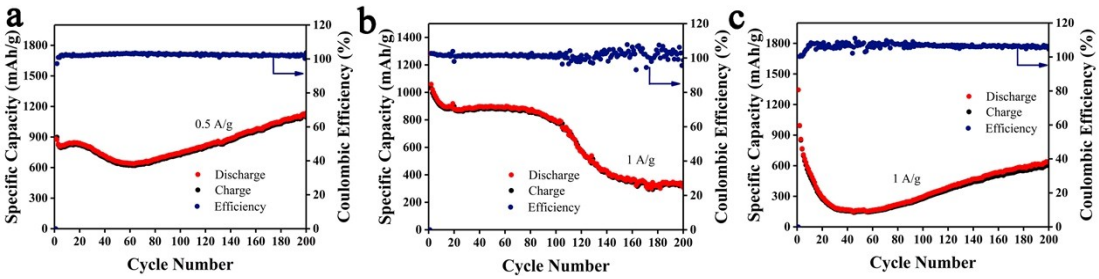

Figure S3. The cycle performance of $Co_3V_2O_8$@NiCo LDH (a), $Co_3V_2O_8$ (b) and NiCo LDH (c)