Supporting Information

Template-Free Synthesis of Mesoporous Co_3O_4 with Controlled Morphologies for Lithium Ion Batteries

Shao-Wei Bian* and Lei Zhu

College of Chemistry, Chemical Engineering and Biotechnology, Donghua University, Shanghai 201620, PR China.

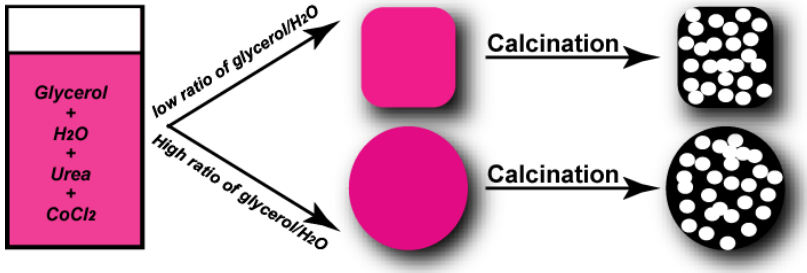
E-mail : swbian@dhu.edu.cn

Experimental Section

Sample preparation: For preparing $CoCO_3$ microspheres, 0.25 g of $CoCl_2 \cdot 6H_2O$ was added into a solution of 5 mL H_2O, 15 mL glycerol and 0.5 g urea at room temperature under stirring. After 1h, this solution was transformed into a Teflon-lined stainless steel autoclave and maintained at 180 °C for 12 h. After the sample was cooled to ambient temperature, the precipitates were collected after being rinsed with pure ethanol and water repeatedly and dried in vacuum at 80 °C. For preparing $CoCO_3$ microcubes, the volume ratio of H_2O and glycerol is 1:1.

Characterization: The microscopic features of the samples were characterized by scanning electron microscopy (SEM, JEOL-6701F) and transmission electron microscopy (TEM, JEOL JEM-2010). The powder X-ray diffraction pattern was collected using a Panalytica X'pert PRO diffractometer. The TGA measurement was carried out under air at a heating rate of 2 °C min^{-1} using a TQ500 instrument. Nitrogen adsorption/desorption isotherms were measured at -196 °C using a Micromeritics ASAP 2020 system.

Electrochemical Measurements: The active material (70 wt.%), carbon black (20 wt.%), and poly(vinylidene fluoride) binder (10 wt.%) in N-methylpyrrolidone were mixed into a homogeneous slurry. The obtained slurry was pasted on copper foil and then dried in a vacuum oven at 80 ^{o}C for 12 h. Electrochemical test cells were assembled in an argon-filled glove box. Lithium foil was used as the counter electrode. A solution of $LiPF_6$ in a 1:1 vol/vol mixture of ethylene carbonate and diethyl carbonate was used as the electrolyte. Celgard 2400 film was used as separator. The cells were charged and discharged galvanostatically in a voltage range of 0.005 and 3.0 V using a Neware battery tester.



Scheme 1 Schematic of preparation of mesoporous Co_3O_4 microspheres and microcubes.

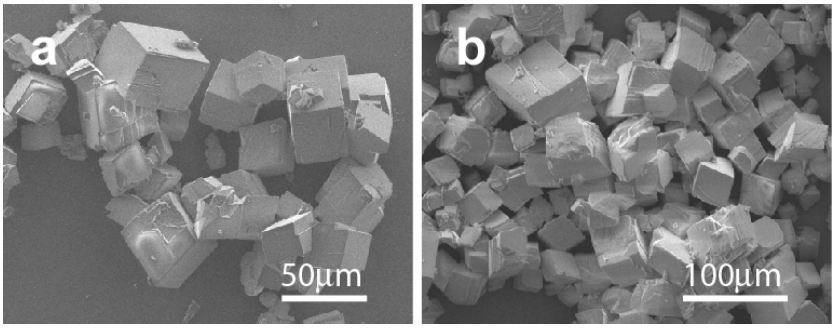


Fig. S1 SEM images of $CoCO_3$ synthesized at a ratio of H_2O and glycerol (volume:volume): (a) 20:0 (b) 15:5.

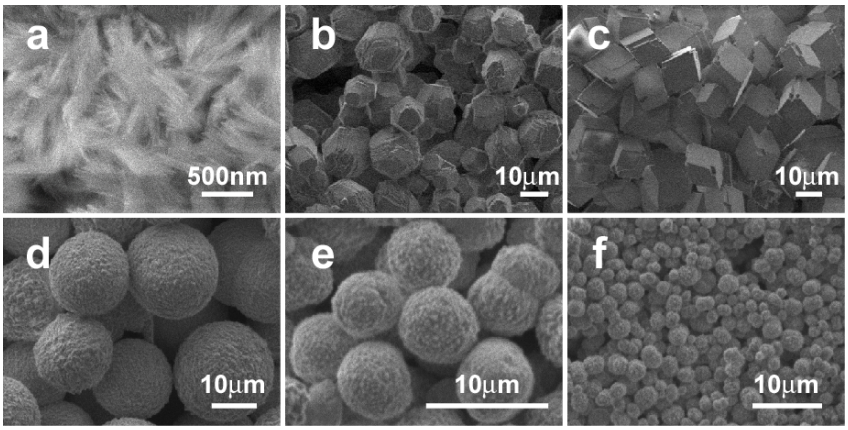


Fig. S2 Effect of the urea concentration on the morphologies of $CoCO_3$ (a, b and c) microcubes and (d, e and f) microspheres: 0.1, 0.2 and 1g urea.

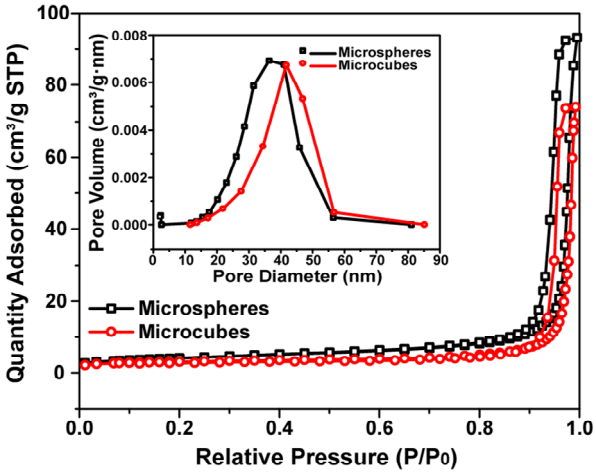


Fig. S3 Nitrogen adsorption/desorption isotherms of mesoporous Co_3O_4 microspheres and microcubes. The inset is BJH pore size distribution.

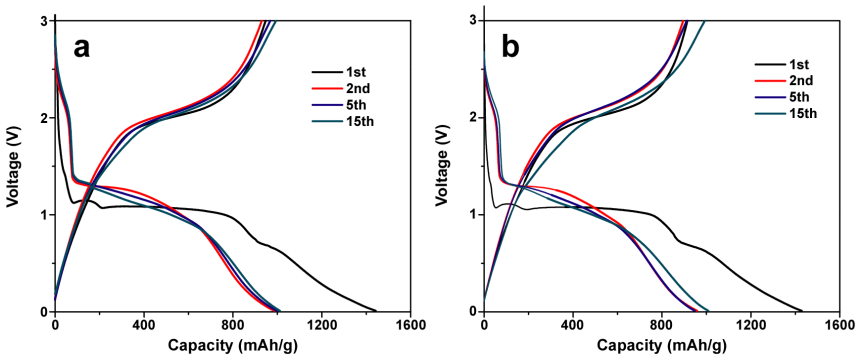


Fig. S4 Discharge-charge profiles of mesoporous Co_3O_4 (a) microspheres and (b) microcubes.