Supporting Information

3D Hierarchically Mesoporous Cu-Doped NiO Hierarchical Nanostructures as High-Performance Anodes Materials for Lithium Ion Batteries

Jingyun Ma, [a,b] Longwei Yin *[,a], Tairu Ge [a]

[a]Key Laboratory for Liquid-Solid Structural Evolution and Processing of Materials, Ministry of Education, School of Materials Science and Engineering, Shandong University, Jinan 250061, P. R. China

[b]Key Laboratory of Processing and Testing Technology of Glass & Functional Ceramics of Shandong Province, Institute of Materials Science and Engineering, Qilu University of Technology, Jinan 250353, P. R. China

*To whom correspondence should be addressed. Tel.: + 86 531 88396970. Fax: + 86 531 88396970.

E-mail: yinlw@sdu.edu.cn

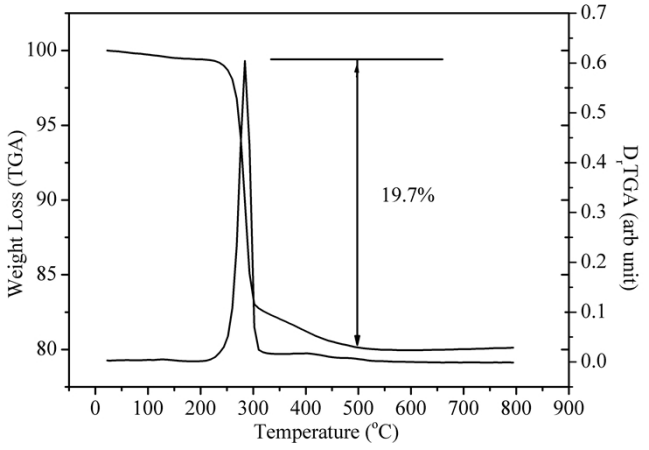

Figure S1. TGA and DTGA curve of β-$Ni(OH)_2$ precursor in air flow.

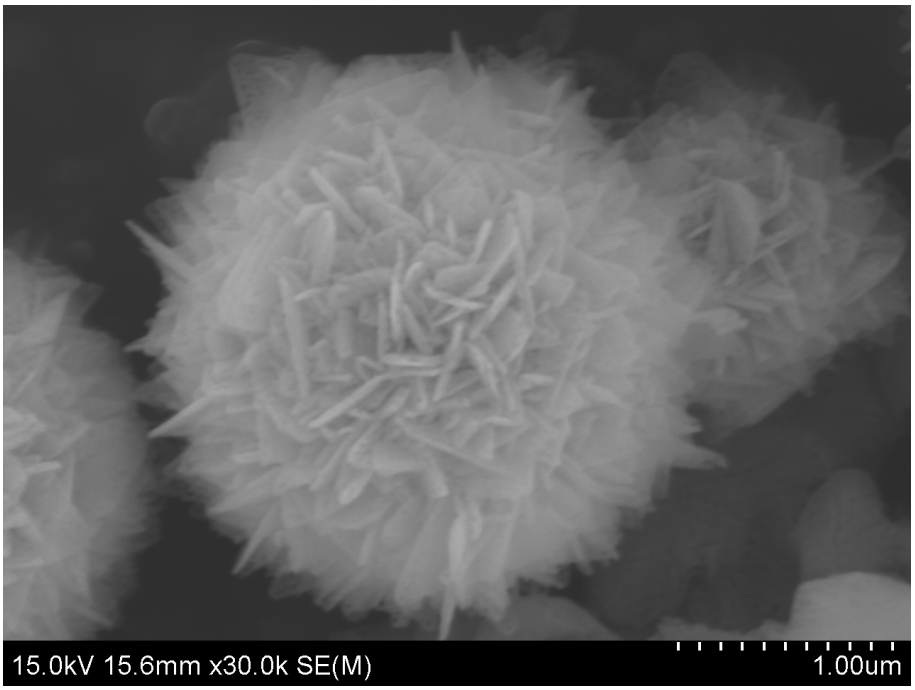

Figure S2. FESEM image of 3D hierarchical mesoporous $Cu_{3\%}NiO$ sample calcinated at 350 ^{o}C.

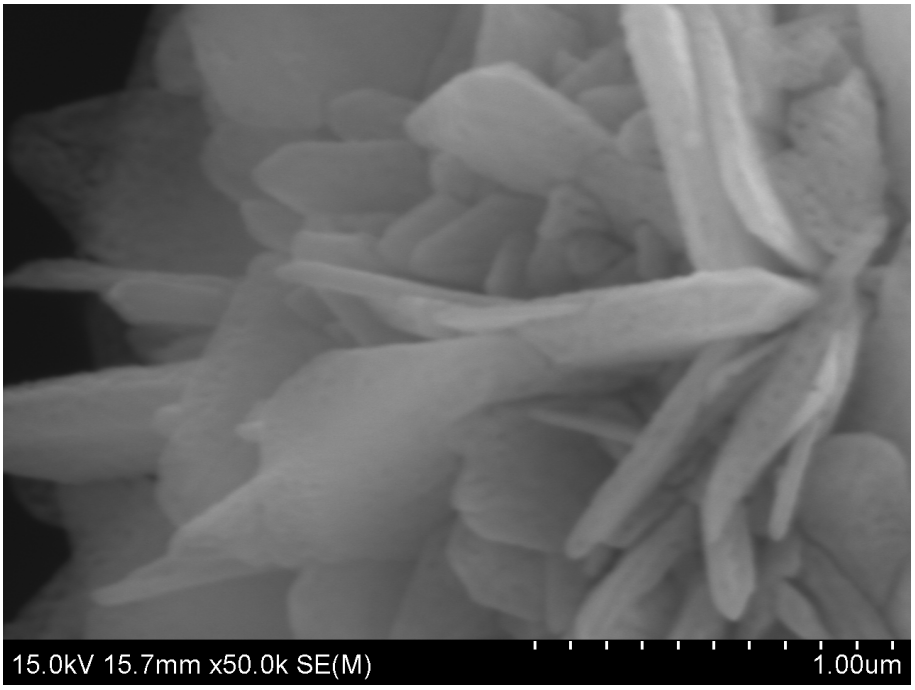

Figure S3. FESEM image of 3D hierarchical mesoporous $Cu_{3\%}NiO$ sample calcinated at 550 ^{o}C.

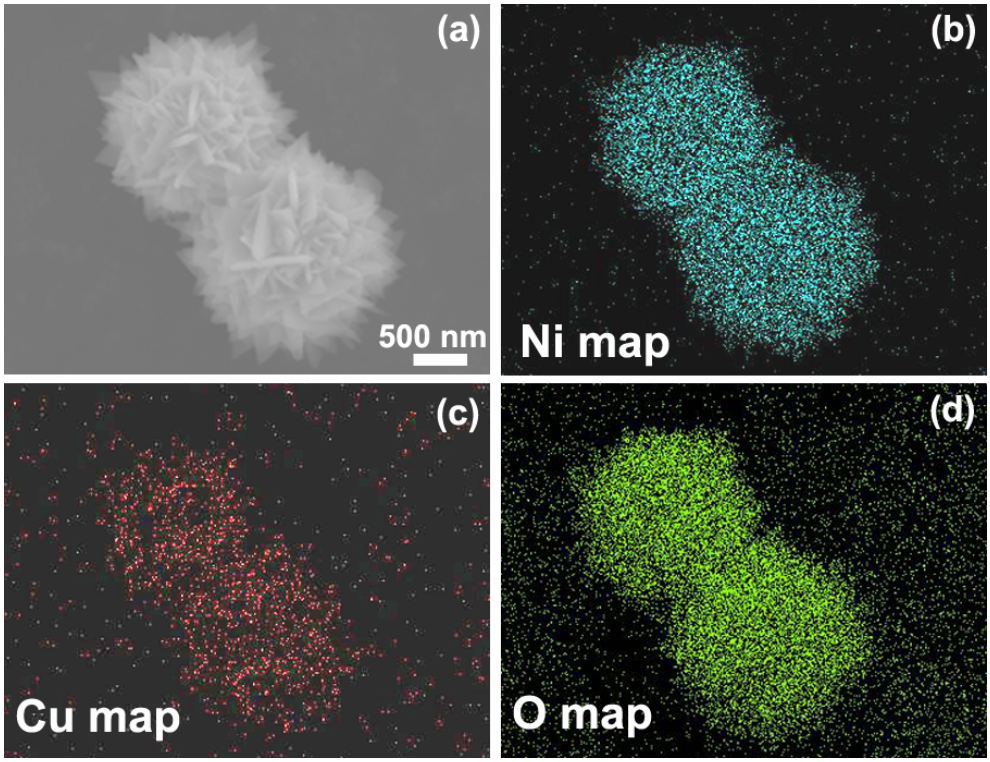

Figure S4. (a-d) SEM image and EDX element mapping of Ni, Cu, and O elements of $Cu_{3\%}NiO$ samples.

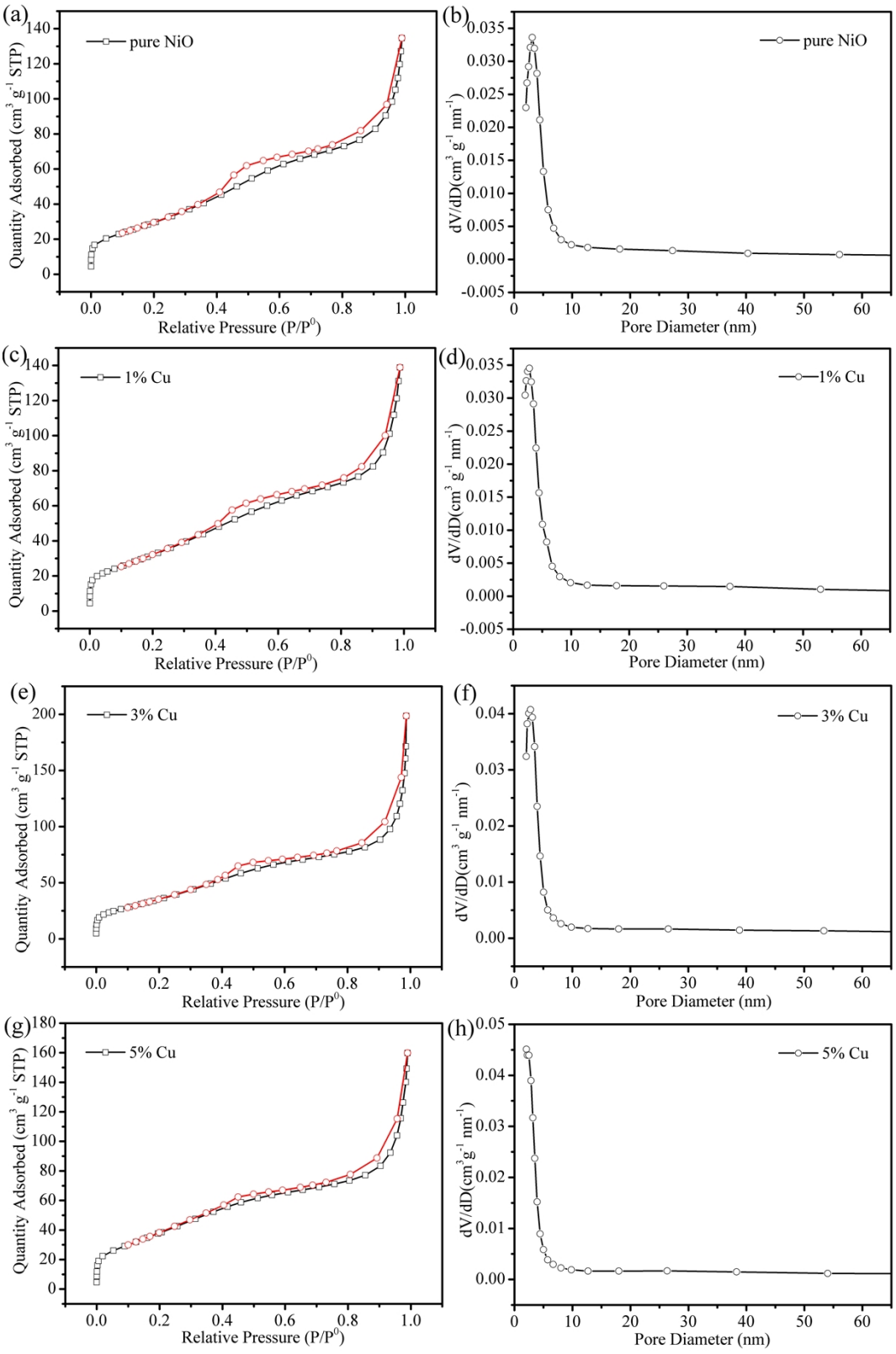

Figure S5. N_2 adsorption/desorption isotherm curve and Barrett–Joyner–Halenda (BJH) pore size distribution plot: (a, b) pure NiO, (c-f) Cu_xNiO samples with different Cu incorporated contents of 1, 3, 5%, repectively.

Table S1. Structural properties of Cu-doped sample samples annealed at 350°C.

Sample	BET surface area /m^2 g^{-1}	Pore diameter volume /nm	Total pore /cm^3 g^{-1}
Pure NiO	112.0	6.6	0.21
1% Cu	119.7	6.8	0.22
3% Cu	131.6	8.7	0.31
5% Cu	142.7	7.6	0.24

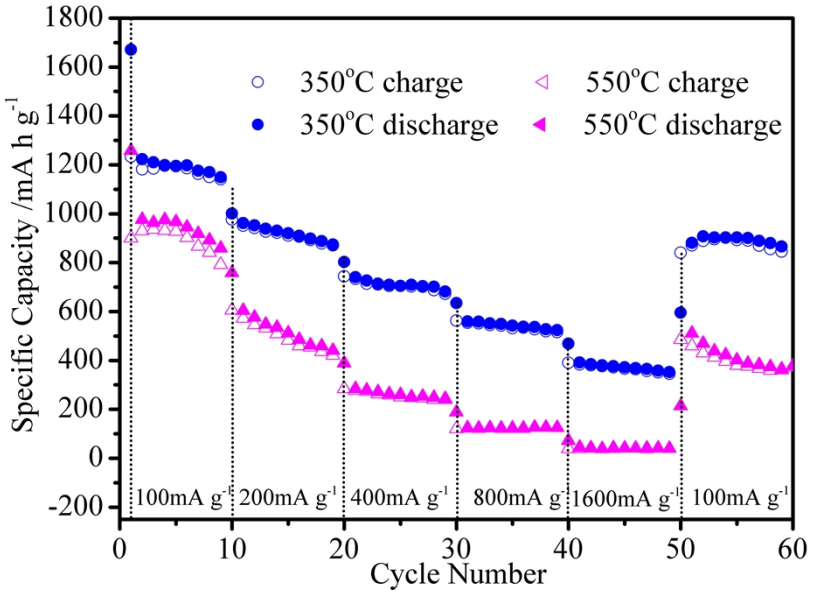

Figure S6. Rate capability of at different current densities from 100 to 1600 mA g^{-1} in the voltage range 3.00-0.01 V versus Li^+/Li for 60 cycles of $Cu_{3\%}NiO$ samples calcinated at temperature of 350 and 550 °C.

The electrochemical impedance spectrum (EIS) was used to investigate the charge transport kinetics for the electrochemical properties of the Cu-doped NiO samples. Nyquist plots (Figure S7) exhibit that the diameter of the semicircle for Cu/Ni=1% (annealing temperature was 350°C) in the high-medium frequency region which attributed to the ohmic resistance is much smaller than that of pure NiO sample, indicating that the porous hollow hierarchical micro/nano-material can facilitate electron transfer from doped Cu ions within the whole electrode and thus decrease resistance. The decrease of charge transfer resistance is profitable to improve the electron and ion kinetics in the composite electrode, consequently, enhancing the electrochemical performance of the Cu-doped NiO.

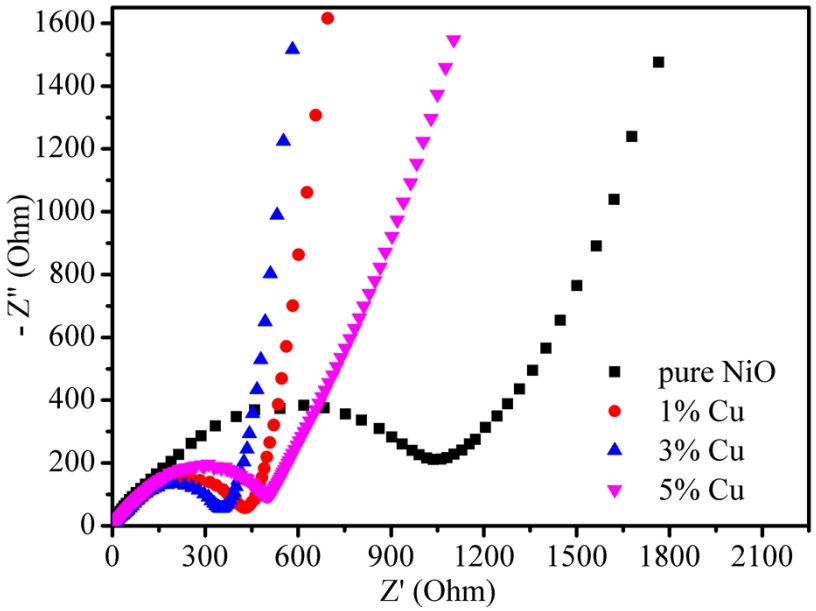

Figure S7. Nyquist plot of synthesized pure NiO, 1 %, 3%, and 5% Cu-doped Cu_xNiO electrodes calcinated at 350 ^oC.