Electronic supplementary information

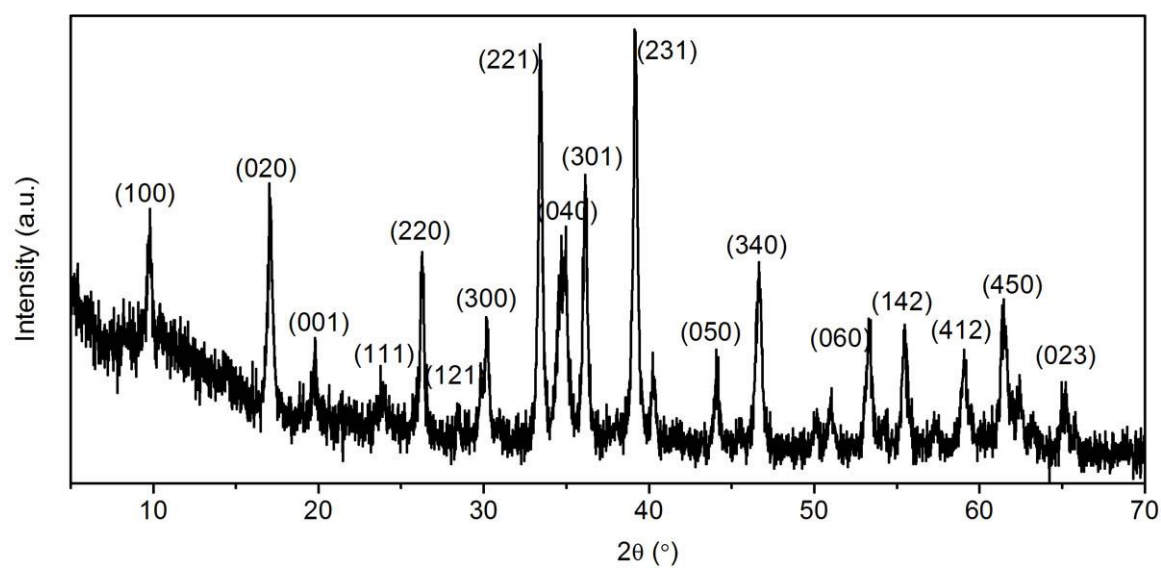# In-plane porous Co_3O_4 nanosheets assembled 3D hierarchical clusters grown on stainless steel mesh as binder-free anodes for high performance lithium ion batteries

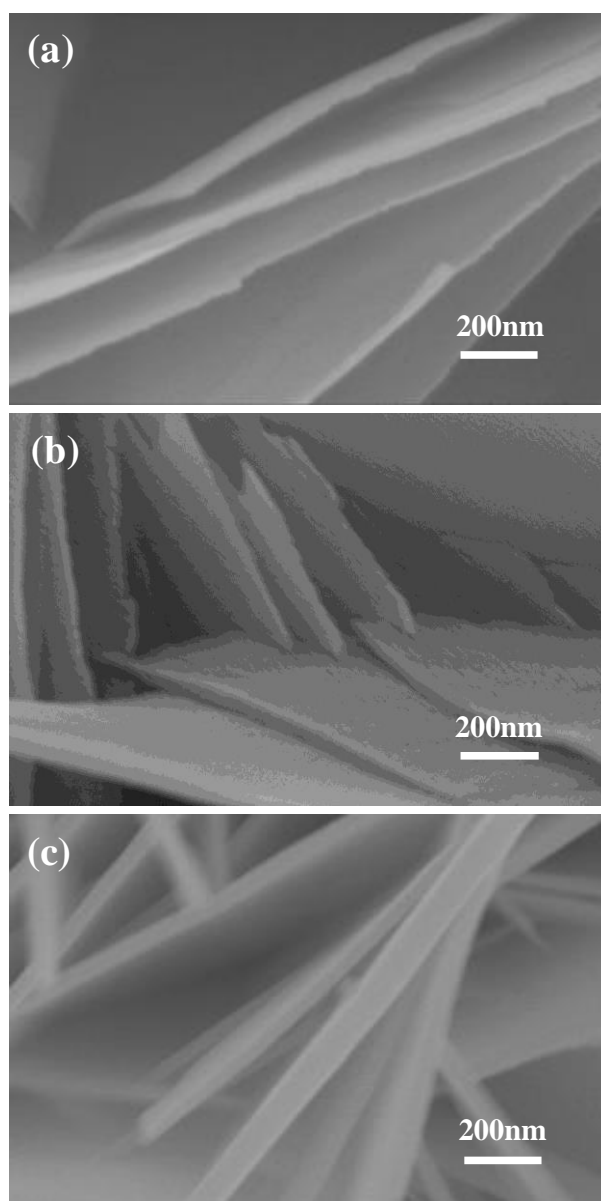Qinxing Xie,[a]* Rui Song,[a] Peng Zhao,[b] Yufeng Zhang,[a] Shihua Wu[b], and Dongliang Xie[a]

[a] Tianjin Key Laboratory of Advanced Fibers and Energy Storage, School of Materials Science and Engineering, Tianjin Polytechnic University, Tianjin 300387, China

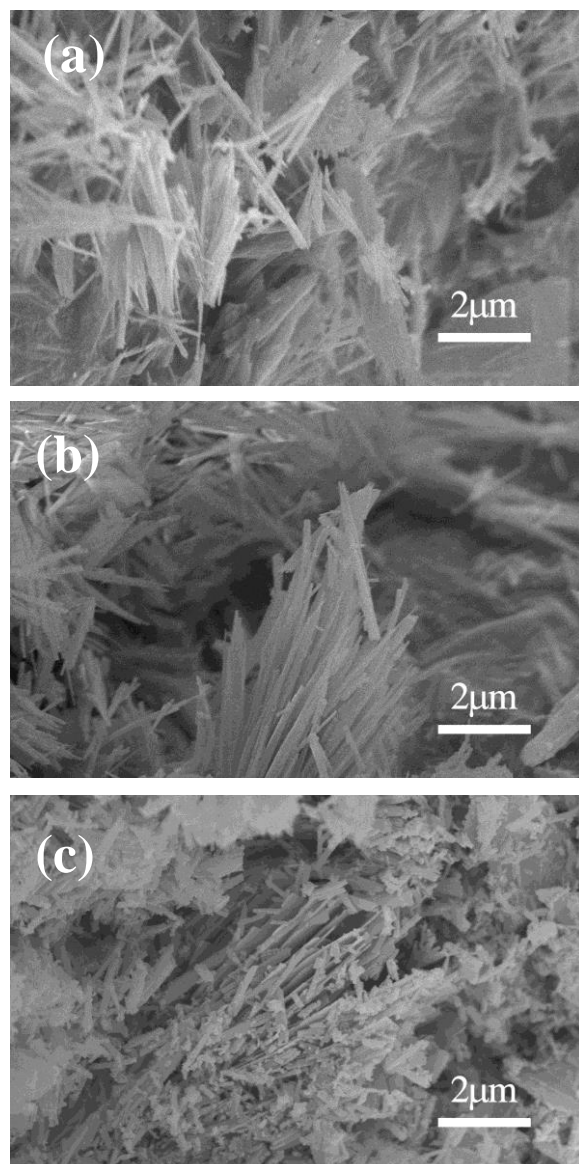[b] Department of Chemistry, Nankai University, Tianjin 300017, China

* Corresponding author. Tianjin Key Laboratory of Advanced Fibers and Energy Storage, School of Materials Science and Engineering, Tianjin Polytechnic University, Tianjin 300387, China. Email address: qxxie@yahoo.com (Q. Xie)
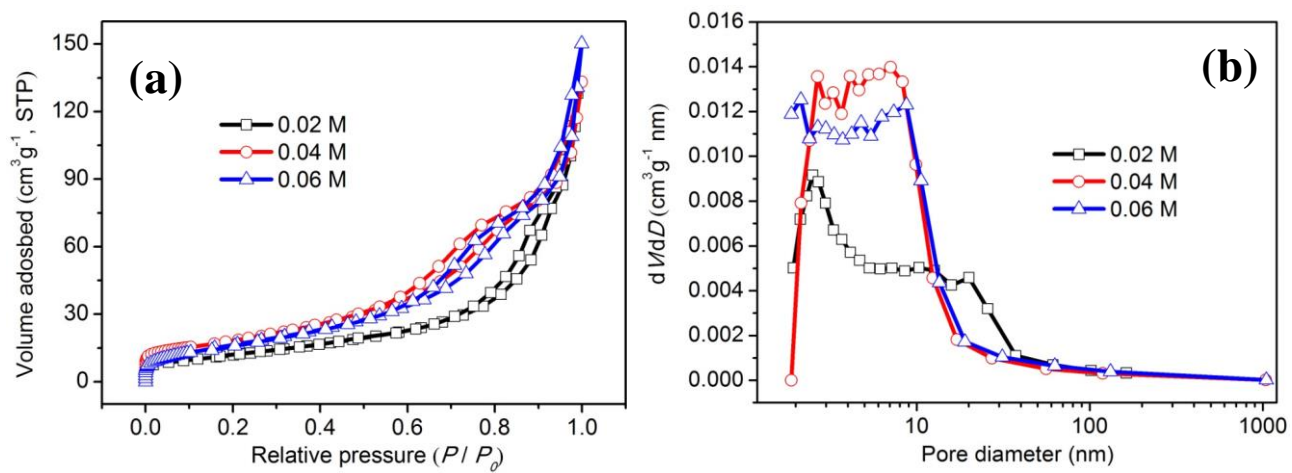
Figure S1. XRD pattern of the intermediate synthesized using the hydrothermal method, the diffraction peaks can be indexed to the orthorhombic $Co(CO_3)_{0.5}(OH) \cdot 0.11H_2O$ (JCPDS No. 48-0083).
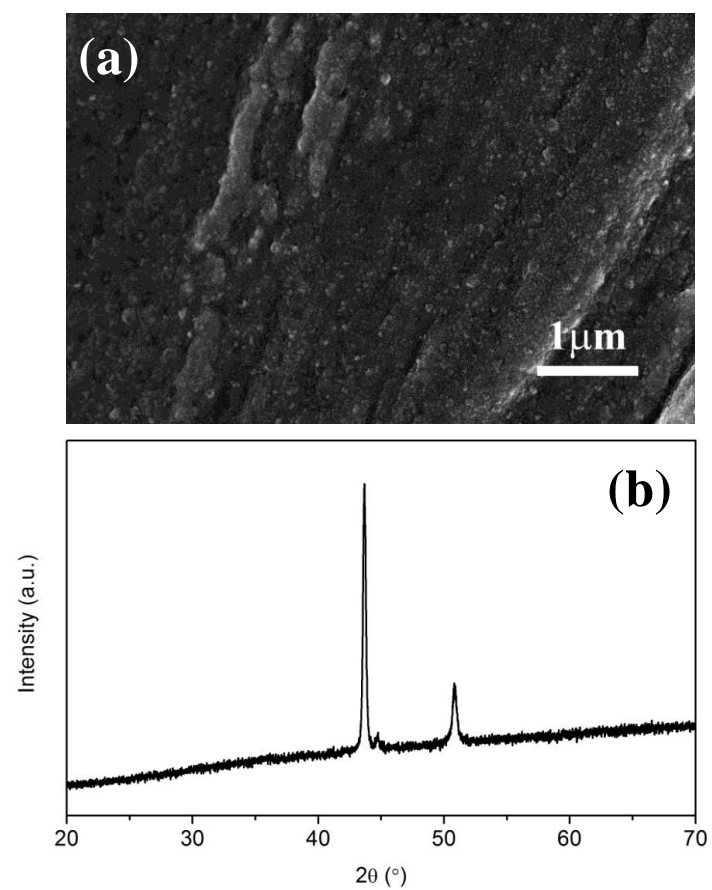
Figure S2. SEM images for Co_3O_4 nanosheets anchored on SSM prepared using the $Co(NO_3)_2$ solutions with varied concentrations: (a) 0.02 M, (b) 0.04 M and (c) 0.06 M.

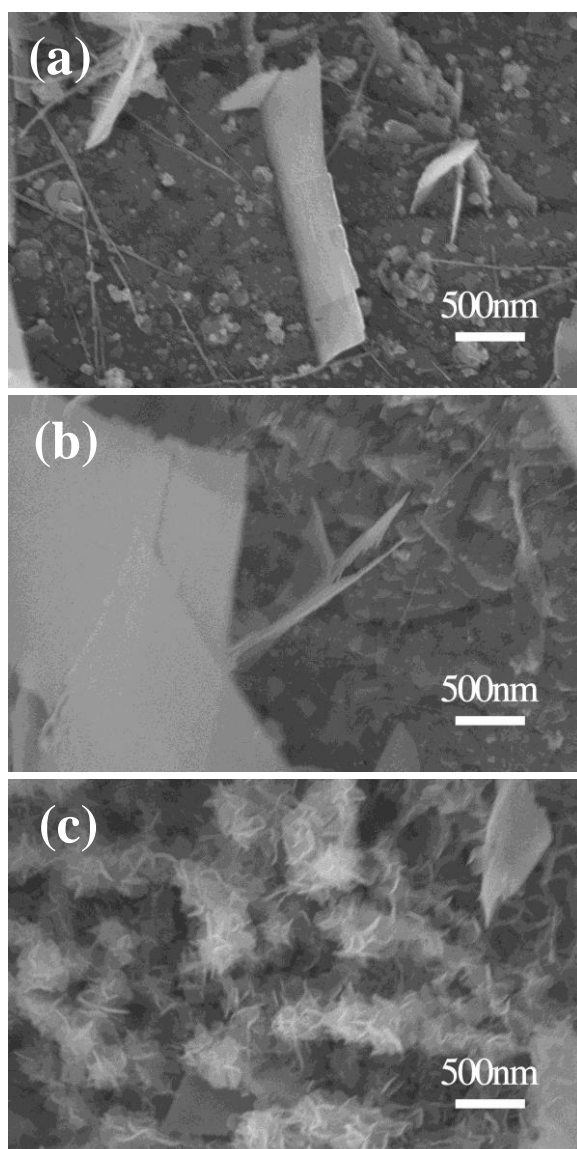**Figure S3.** SEM images of the powdered Co_3O_4 samples obtained using the $Co(NO_3)_2$ solutions with varied concentrations: (a) 0.02 M, (b) 0.04 M, and (c) 0.06 M.
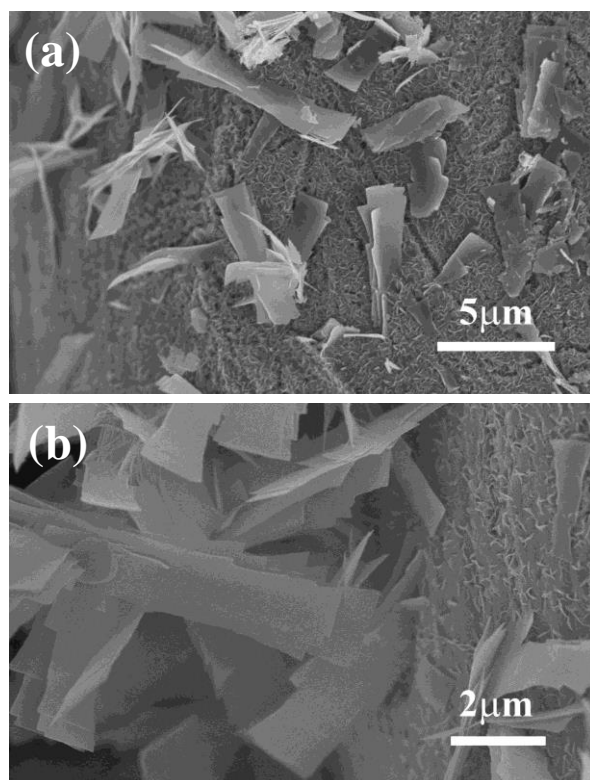
Figure S4. (a) Nitrogen sorption isotherm curves and (b) pore size distributions for the Co_3O_4 samples prepared using the $Co(NO_3)_2$ solutions with varied concentrations.

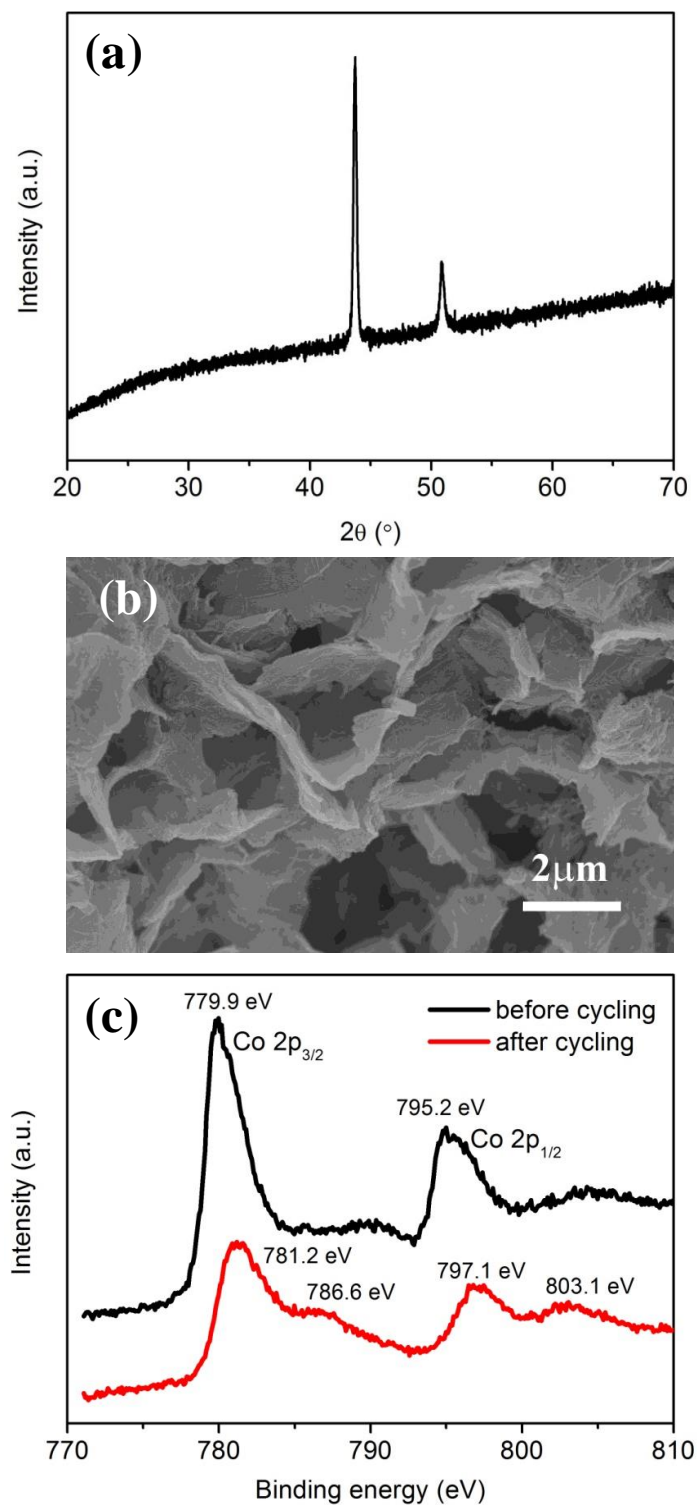**Figure S5**. (a) SEM image and (b) XRD pattern for the "soil" coated SSM.

Figure S6. SEM images of the SSM surface underneath the nanosheet clusters for the samples prepared using the $Co(NO_3)_2$ solutions with varied concentrations: (a) 0.02 M, (b) 0.04 M, and (c) 0.06 M.

Figure S7. SEM images for the Co_3O_4@SSM sample prepared using 0.04 M $Co(NO_3)_2$ solution and SSM substrate without the pre-deposited thin layer of cobalt oxide as the "soil": (a) the nanosheets grown on SSM surface and (b) the nanosheet aggregation in mesh pores.

Figure S8. (a) XRD pattern and (b) SEM image for Co_3O_4@SSM (0.04) after 50 cycles, as well as

(c) Co 2p XPS spectra for the electrode before and after cycling.