Supporting information

Hierarchical $Cu_{0.27}Co_{2.73}O_4/MnO_2$ nanorod arrays grown on 3D nickel foam as promising electrode materials for electrochemical capacitors

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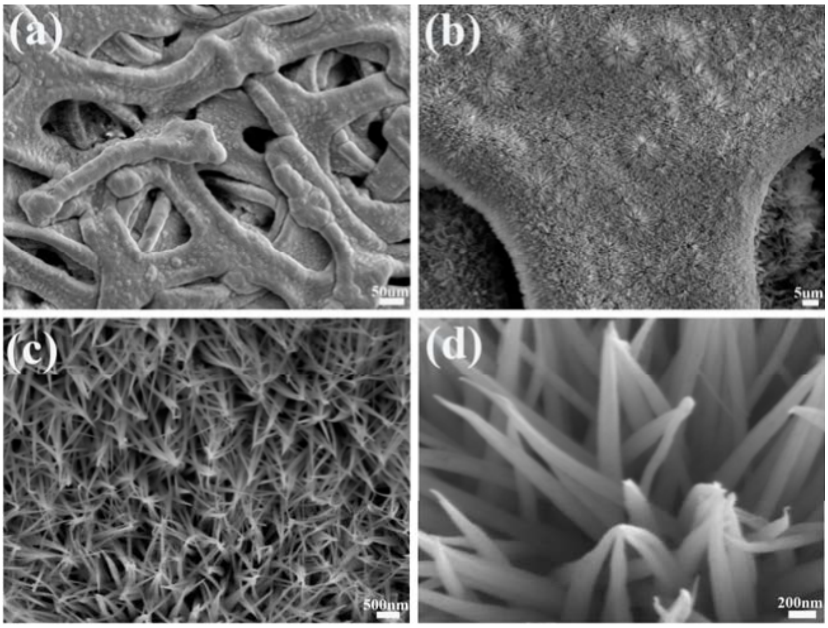

Fig. S1. SEM images of precursor to $Cu_{0.27}Co_{2.73}O_4$ with different magnifications.

Fig. S1 Shows the different magnified SEM images of the precursor to $Cu_{0.27}Co_{2.73}O_4$ grown on the nickle foam.

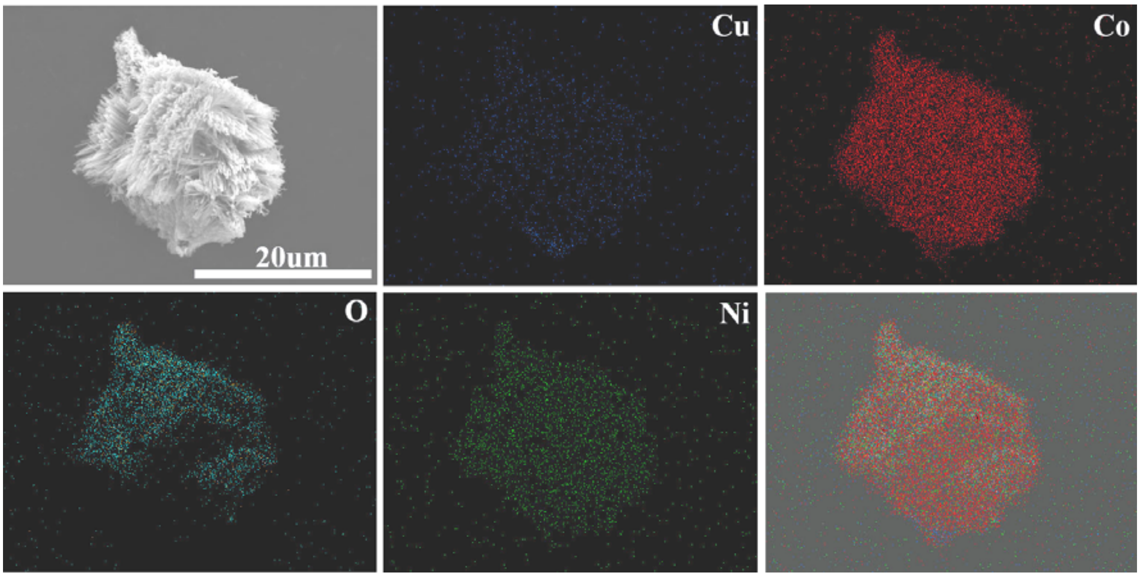

Fig. S2. Energy dispersive X-ray spectrometry mapping analysis of $Cu_{0.27}Co_{2.73}O_4$, and combined map of the existent elements.

The elements composition of $Cu_{0.27}Co_{2.73}O_4$ were further determined by Energy Dispersive X-ray spectrometry mapping analysis, shown in **Figure S2**.

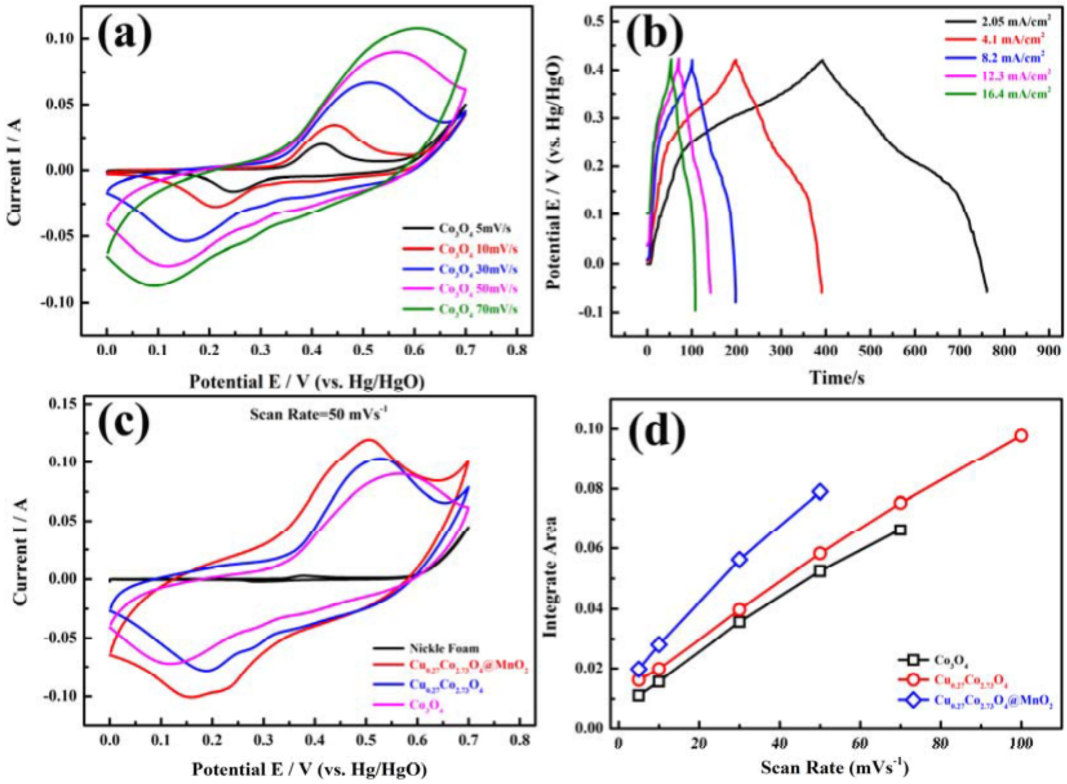

Fig. S3. (a) CV curves of Co_3O_4 at different scan rates, (b) Galvanostatic charge-discharge (GCD) curves of Co_3O_4 at different current densities (within the potential window from -0.05 to 0.42V), (c) CV curves for $Cu_{0.27}Co_{2.73}O_4$, $Cu_{0.27}Co_{2.73}O_4$@MnO_2, Co_3O_4 and nickle foam at a scan rate of 50 mVs^{-1} (d) The integrate area of CV curves versus scan rates for $Cu_{0.27}Co_{2.73}O_4$ and $Cu_{0.27}Co_{2.73}O_4$@MnO_2.

The CV measurement for Co_3O_4 is conducted at different scan rates from 5 to 70 mVs^{-1} within 0-0.7V. A pair of expanded redox peaks is observed and all profiles exhibits the similar shapes. As the scan rate increases, the current density and integral area of the CV curves increase., as **in Fig. S3.**(a) shown. The mass loading of Co_3O_4 is ~ 4.1mgcm^{-2}. GCD curves of Co_3O_4 also rely on the GCD profiles (**Fig. S3.**(b) shows), we figure out the capacitance through eq. 6 and 7. The capacitance at different current densities (from 2.05 to 16.4 mAcm^{-2}) is 1.85, 1.80, 1.77, 1.74, 1.67 Fcm^{-2}, respectively. C_a of $Cu_{0.27}Co_{2.73}O_4$ at 2.2, 4.4, 8.8, 13.2, 17.6 mAcm^{-2}, is 2.73, 2.68, 2.42, 2.33, 2.24 Fcm^{-2}, while C_a of $Cu_{0.27}Co_{2.73}O_4/MnO_2$ at 3.1, 6.2, 12.4, 18.6 and 24.8 mAcm^{-2} is 3.40, 3.35, 3.27, 3.13 and 3.10 Fcm^{-2}, respectively. Both of them are much higher than those of Co_3O_4. ~90% of C_a retained when current density increases from 2.05 to 16.4mAcm^{-2} for Co_3O_4, exhibiting excellent rate capability.

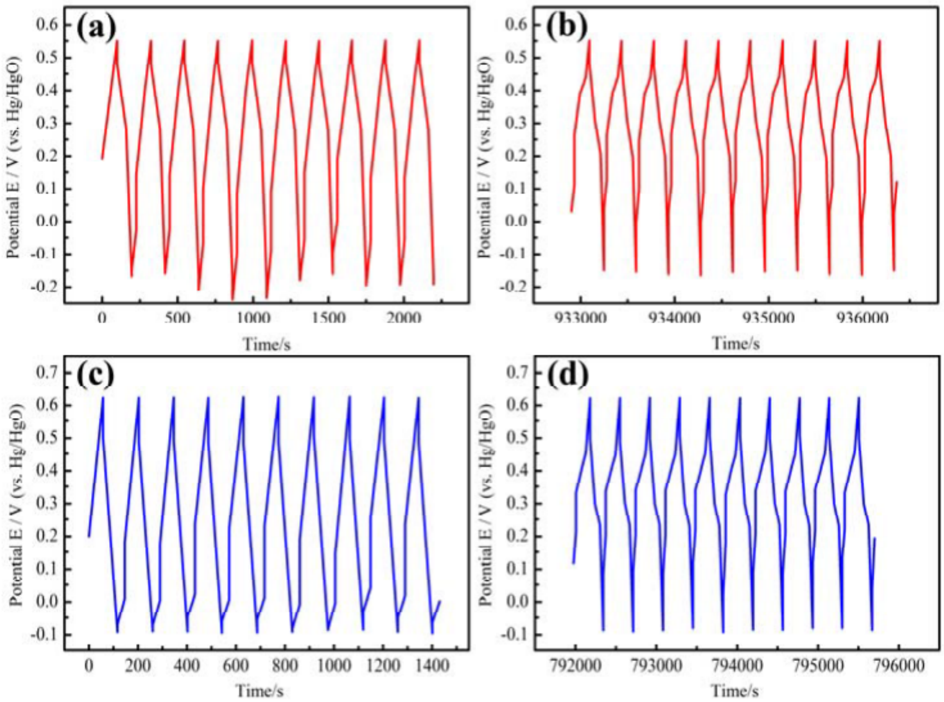

Fig. S4. (a) The first 10 and (b) last 10 charge-discharge curves during 3000 cycles for $Cu_{0.27}Co_{2.73}O_4$ at 8.8 mAcm^2; (c) The first 10 and (d) last 10 charge-discharge curves during 3000 cycles for $Cu_{0.27}Co_{2.73}O_4$@MnO_2 at 18.6 mAcm^2.