Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Engineering hierarchical nanotree with $CuCo_2O_4$ trunk and NiO branches for high-performance supercapacitors

Kangwen Qiu[a,b], Min Lu[b], Yongsong Luo*[b], Xiwen Du*[a]

[a]*Institute of New-Energy Materials, School of Materials Science and Engineering, Tianjin Unviersity, Tianjin 300072, P.R. China.*

[b]*School of Physics and Electronic Engineering, Xinyang Normal University, Xinyang 464000, P. R. China.*

* To whom correspondence should be addressed：E-mail: xwdu@tju.edu.cn, ysluo@xynu.edu.cn

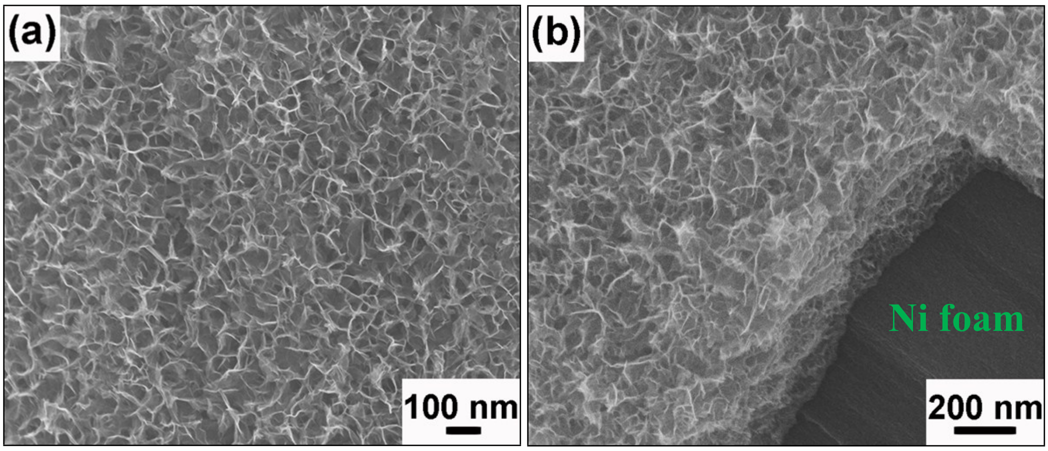

Fig. S1 (a~b) SEM images of NiO films on Ni foam at different magnification.

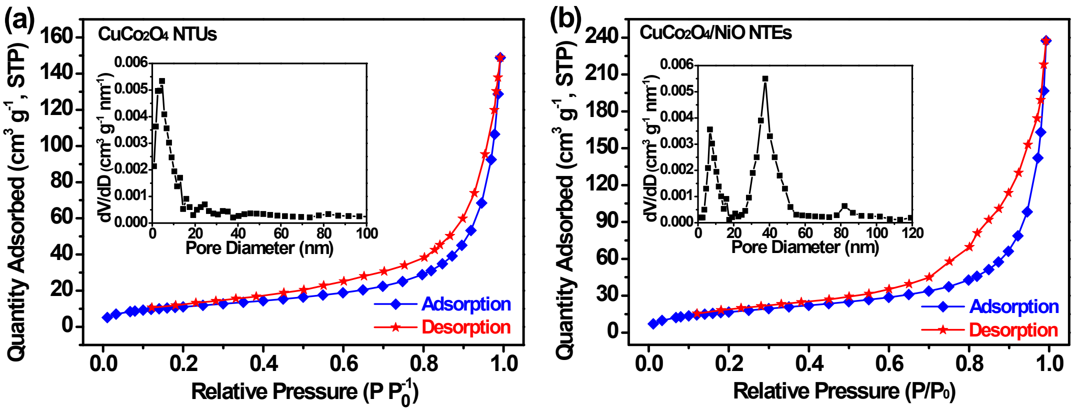

Fig. S2 Nitrogen adsorption-desorption isotherms and pore-size distribution curves for (a) $CuCo_2O_4$ branches and (b) $CuCo_2O_4$/NiO NTEs.

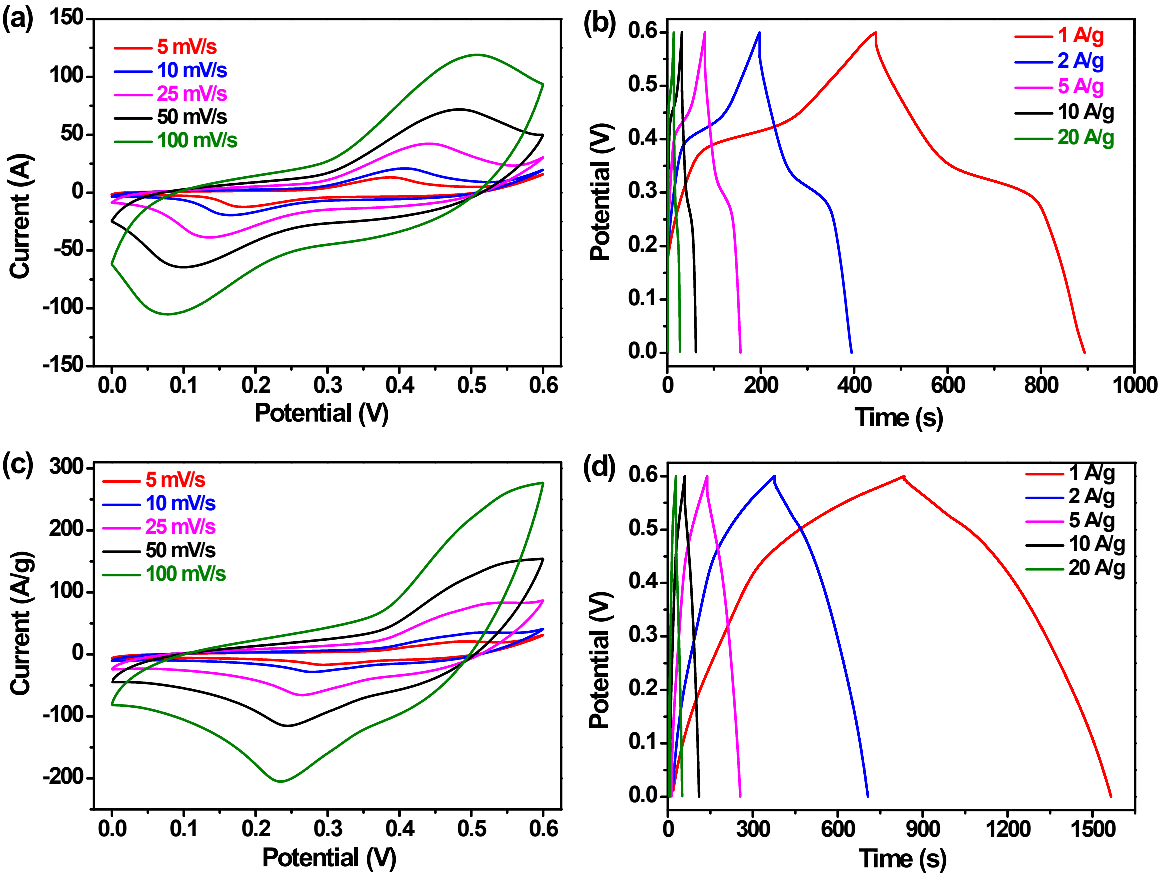

Fig. S3 (a, c) Cyclic voltammograms of $CuCo_2O_4$ NTUs and NiO branches obtained at different scan rates, respectively; and (b, d) charge/discharge curves of $CuCo_2O_4$ trunks and NiO braches electrodes at different current densities, respectively.

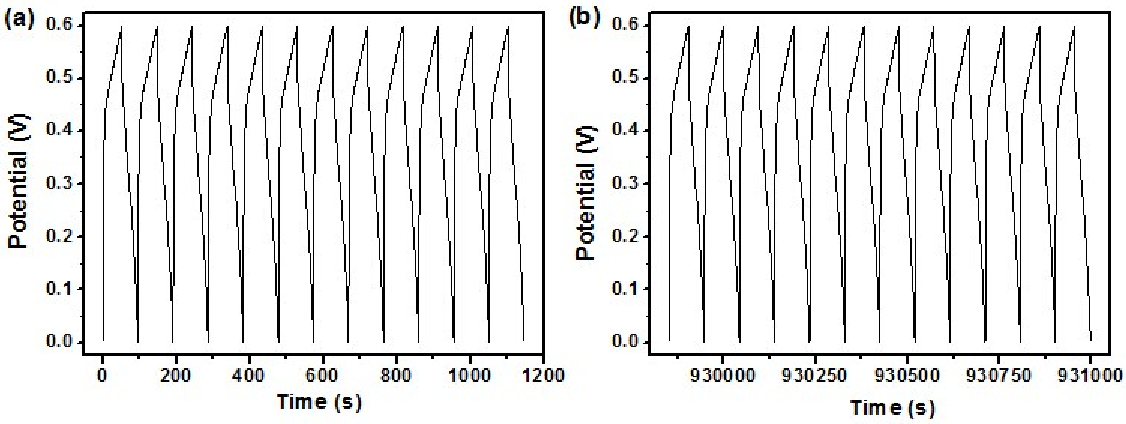

Fig. S4 Charge/discharge curves of the first 12 and last 12 cycles of the $CuCo_2O_4$/NiO electrode at the current density of 20 A g^{-1}.

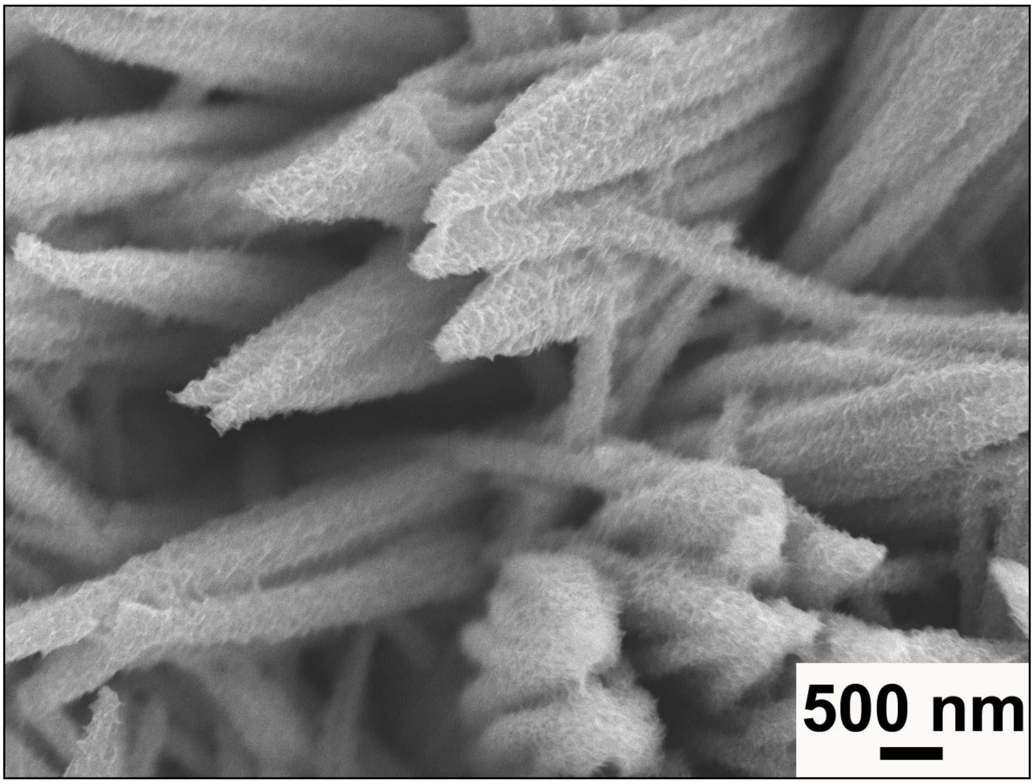

Fig. S5 Typical SEM of the $CuCo_2O_4$/NiO nanotrees after 10000 cycles.

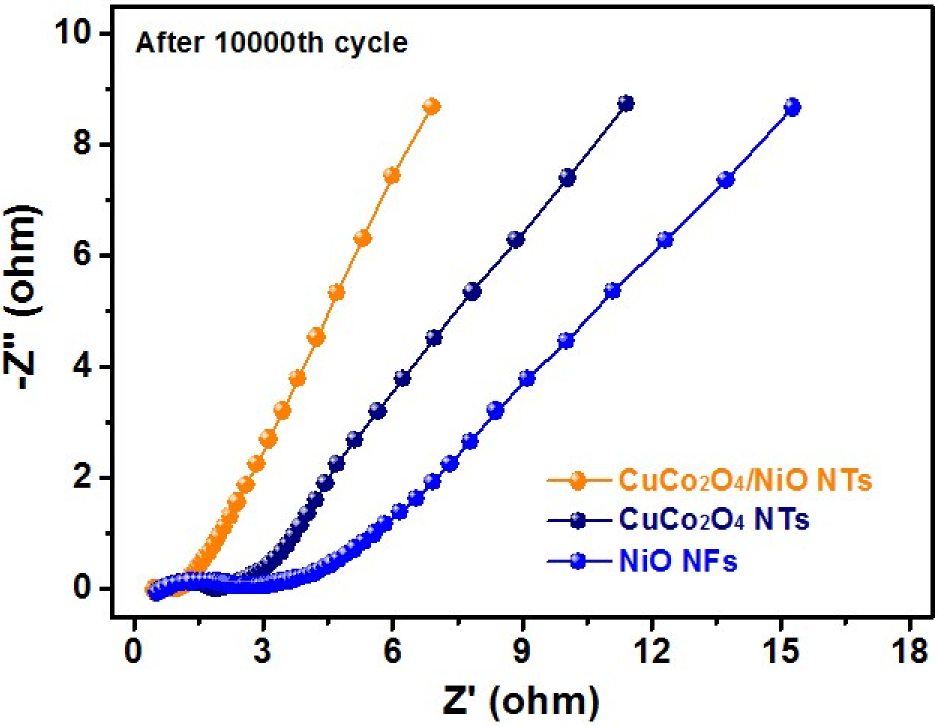

Fig. S6 Electrochemical impedance spectra (EIS) of the $CuCo_2O_4$, NiO and $CuCo_2O_4$/NiO electrodes measured after 10000th cycle at 20 A g^{-1}.

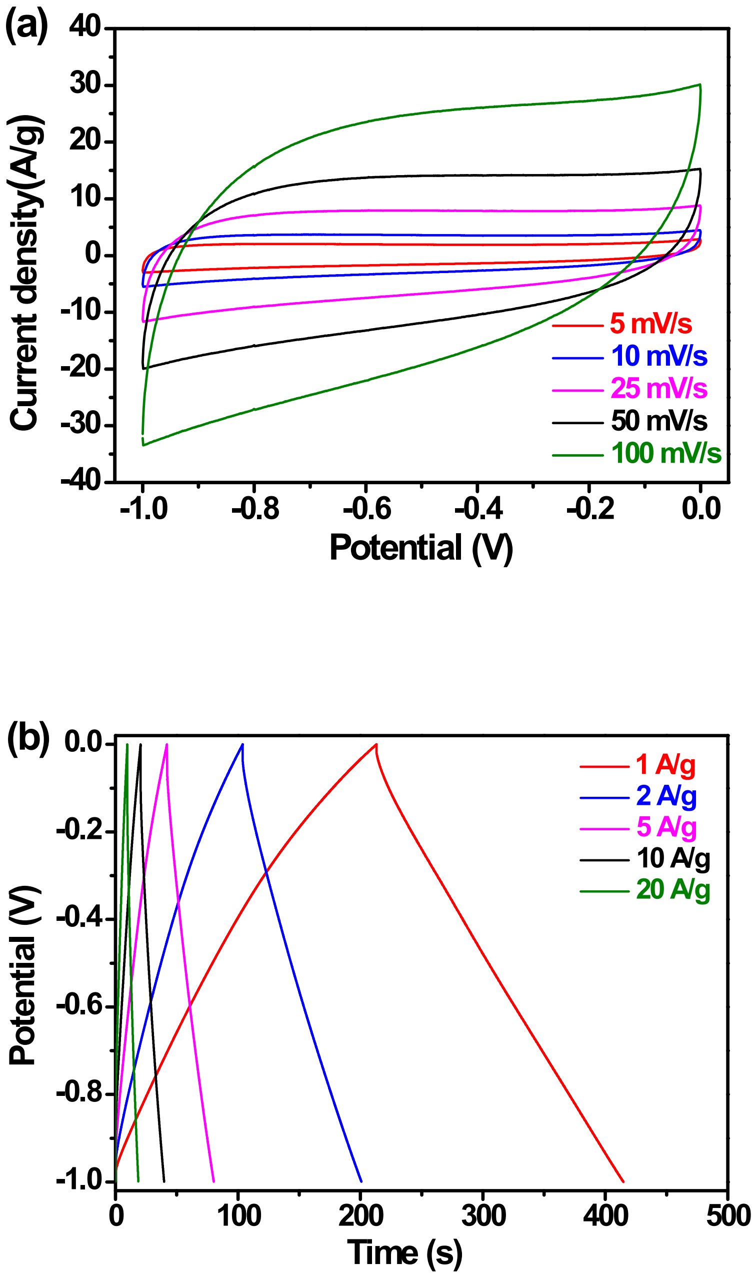

Fig. S7 (a) CV curves of activated carbon (AC) at various sweep rates and (b) galvanostatic charge/discharge voltage profiles at different current densities.

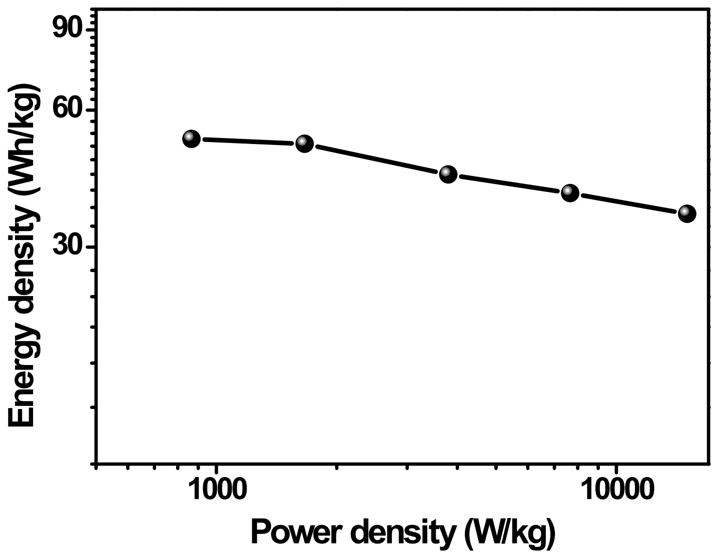

Fig. S8 Ragone plots of the $CuCo_2O_4$/NiO//AC ASC.

Table S1 Comparison of specific capacitances of $CuCo_2O_4$/NiO nanotrees with different nanostructured electrodes reported in literature.

Electrode structure	Specific capacitance	Reference
$CuCo_2O_4$/NiO nanotrees	2219 F g^{-1} at 1 A g^{-1}	this study
$CuCo_2O_4$/NiO nanotrees	2043 F g^{-1} at 2 A g^{-1}	this study
TiO_2@MnO_2 nanobelts	128 F g^{-1} at 1 A g^{-1}	1
Co_3O_4@MnO_2 nanoneedles	1693 F g^{-1} at 1 A g^{-1}	2
Co_3O_4@$Co(OH)_2$ nanowires	1095 F g^{-1} at 1 A g^{-1}	3
Co_3O_4@NiO nanowires	853 F g^{-1} at 2 A g^{-1}	4
Zn_2SnO_4@MnO_2 nanocable	642 F g^{-1} at 1 A g^{-1}	5
$MnMoO_4$@$CoMoO_4$ nanowires	187 F g^{-1} at 1 A g^{-1}	6
$ZnCo_2O_4$@$NiCo_2O_4$ nanowires	1476 F g^{-1} at 1 A g^{-1}	7
Co_3O_4@MnO_2 nanoconches	1693 F g^{-1} at 1 A g^{-1}	8
ZnO@MnO_2 nanowires	275 F g^{-1} at 2 A g^{-1}	9
TiO_2/NiO nanorods	611 F g^{-1} at 2 A g^{-1}	10

References

1. Y. S. Luo, D.Z. Kong, J.S. Luo, S. Chen, D.Y. Zhang, K.W. Qiu, X.Y. Qi, H. Zhang, C.M. Li, T. Yu, *RSC Advances,* 2013, **3**, 14413-14422.
2. D. Z. Kong, J. S. Luo, Y. L. Wang, W. N. Ren, T. Yu, Y. S. Luo, Y. P. Yang, C. W. Cheng, *Adv. Func. Mater*., 2014, **24***,* 3815-3826.
3. X. H. Xia, J. P. Tu, Y. Q. Zhang, J. Chen, X. L. Wang, C. D. Gu, C. Guan, J. S. Luo, H. J. Fan, *Chem. Mater*., 2012, **24**, 3793-3799.
4. X. H. Xia, J. P. Tu, Y. Q. Zhang, X. L. Wang, C. D. Gu, X. B. Zhao, H. J. Fan, *ACS Nano,* 2012, **6**, 5531-5538.
5. L. H. Bao, J.F. Zang, X.D. Li, *Nano lett*., 2011, **11**, 1215-1220.
6. L. Q. Mai, F. Yang, Y. L. Zhao, X. Xu, L. Xu, Y. Z. Luo, *Nat. Commun*., 2011, **2**, 381.
7. Y. P. Huang, Y. E. Miao, H. Y. Lu, T. X. Liu, *Chem. Eur. J*., 2015, **21**, 10100-10108.
8. K. W. Qiu, H. L. Yan, D. Y. Zhang, Y. Lu, J. B. Cheng, M. Lu, C. L. Wang, Y. H. Zhang, X. M. Liu, Y. S. Luo, *J. Solid State Electrochem*., 2014, **19**, 391.

9. M. P. Yu, H. T. Sun, X. Sun, F. Y. Lu, G. K. Wang, T. Hu, H. Qiu, J. Lian, *Int. J. Electrochem. Sci*., 2013, **8**, e29.
10. J. B. Wu, R. Q. Guo, X. H. Huang, Y. Lin, *J. Power Sources,* 2013, **243**, 317-322.