Supporting Information for

Hierarchical Core/Shell Janus-type α-Fe_2O_3/PEDOT Nanoparticles for High Performance Flexible Energy Storage Devices

*Jin Wook Park, Wonjoo Na and Jyongsik Jang**

[*] Prof. J. Jang, J. W. Park, W. Na
School of Chemical and Biological Engineering, Seoul National University, Seoul 151-742, Korea
E-mail: jsjang@plaza.snu.ac.kr

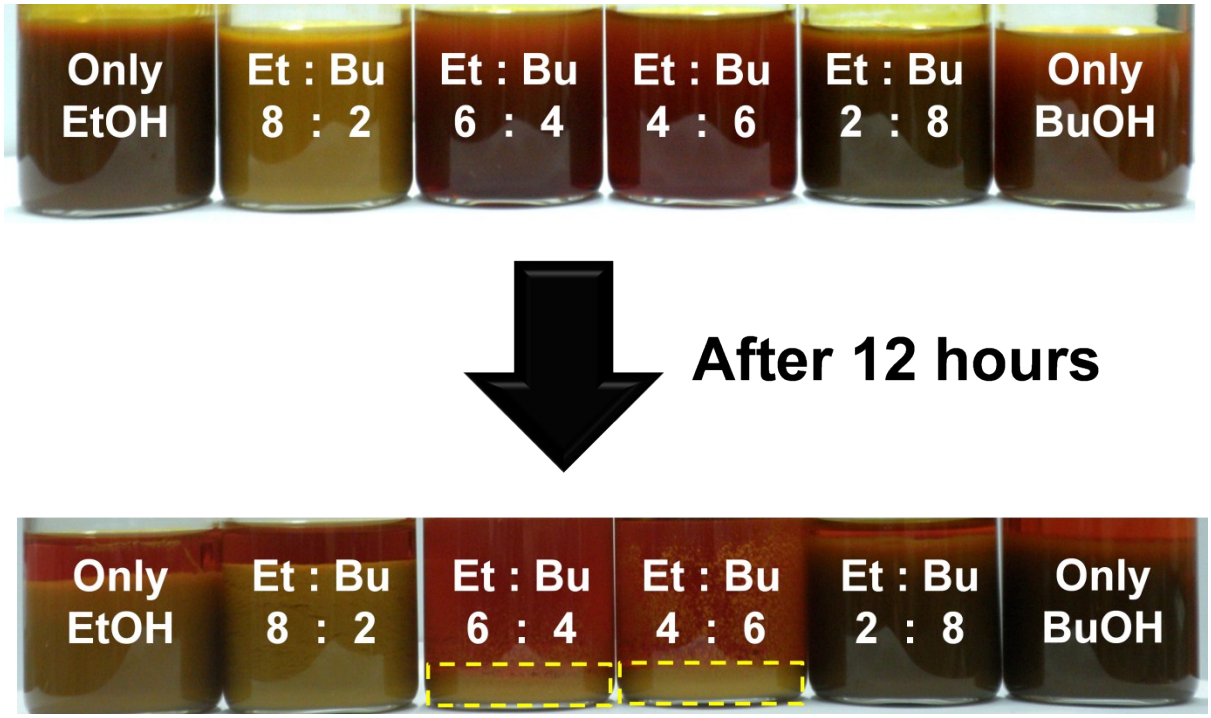

Figure S1 Photographs of samples prepared at various solvent mixing ratios after 1 h of ultrasonication.

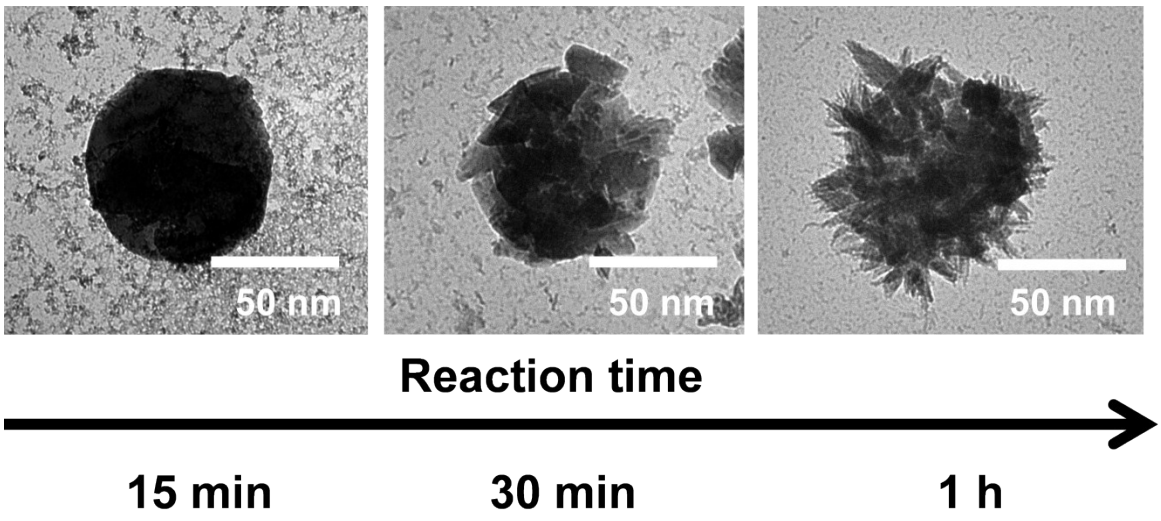

Figure S2 TEM micrographs of α-Fe_2O_3+PEDOT HNPs as a function of reaction time.

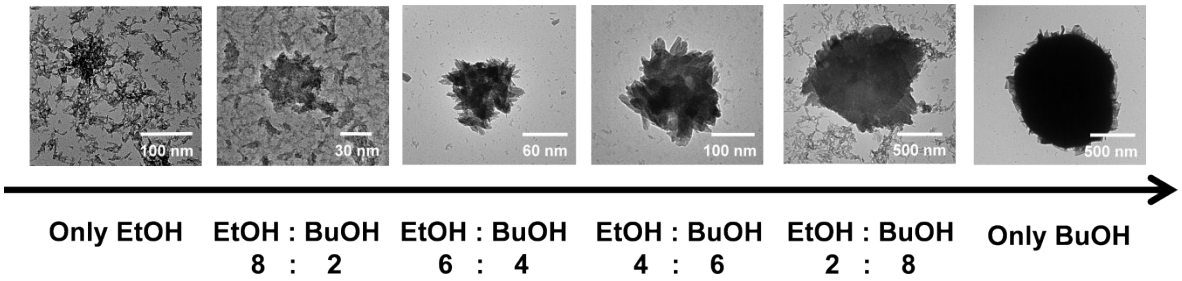

Figure S3 TEM micrographs of α-Fe_2O_3+PEDOT HNPs as a function of solvent ratio after 1 h of ultrasonication.

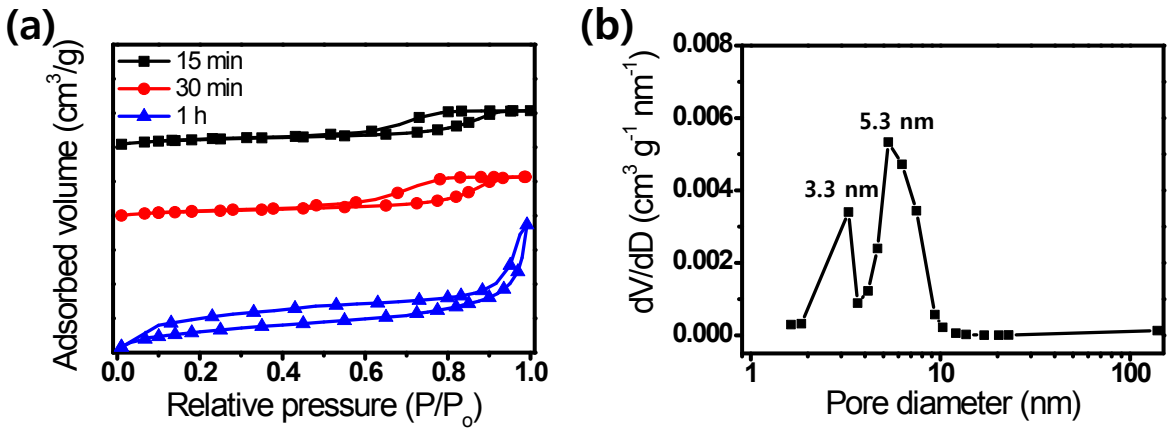

Figure S4 (a) N_2 adsorption/desorption isotherms of FeO_x NPs as a function of reaction time (15, 30 min, and 1 h) (b) Barrett–Joyner–Halenda (BJH) pore size distribution curves of FeO_x NPs.

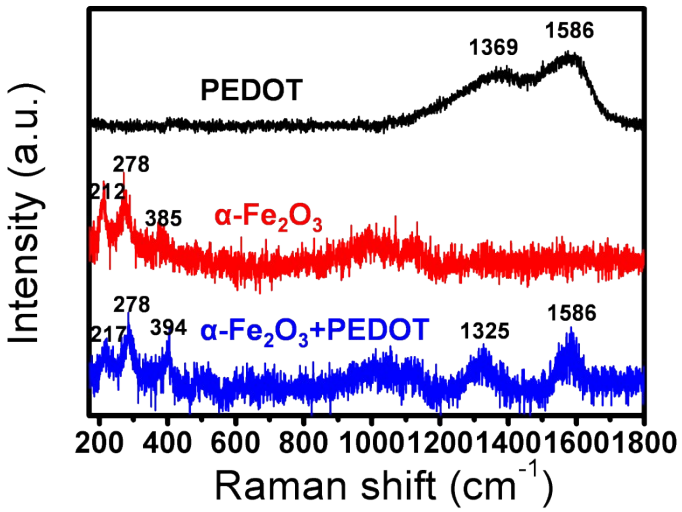

Figure S5 Raman spectra of PEDOT, α-Fe_2O_3, and α-Fe_2O_3+PEDOT HNPs.

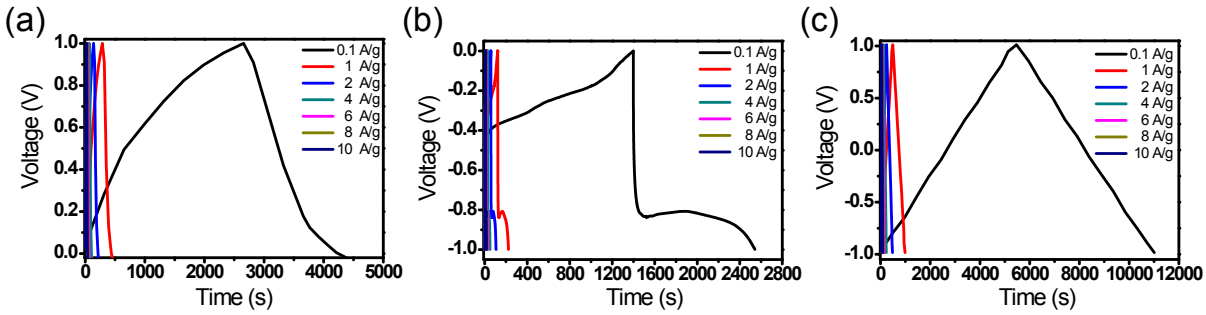

Figure S6 Galvanostatic charge–discharge curves of (a) PEDOT, (b) α-Fe_2O_3, and (c) α-Fe_2O_3+PEDOT HNPs at various current densities.

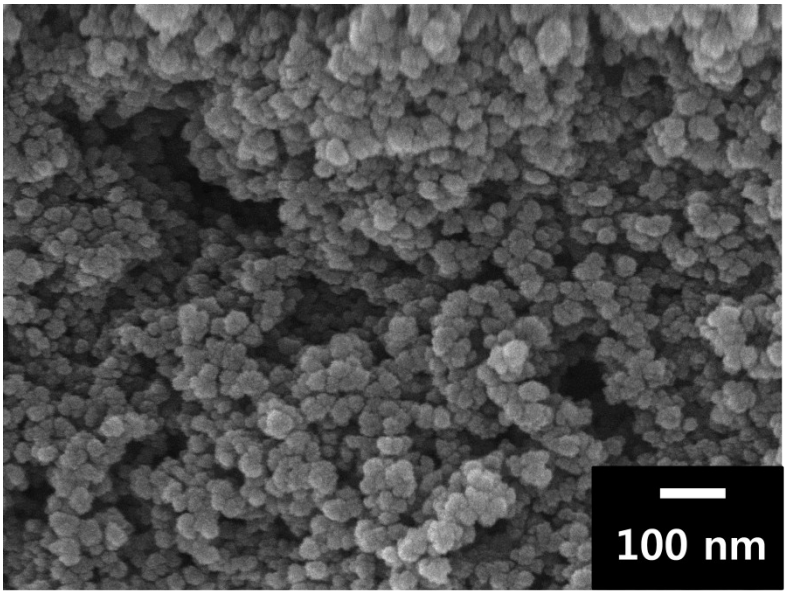

Figure S7 SEM image of PEDOT NPs.

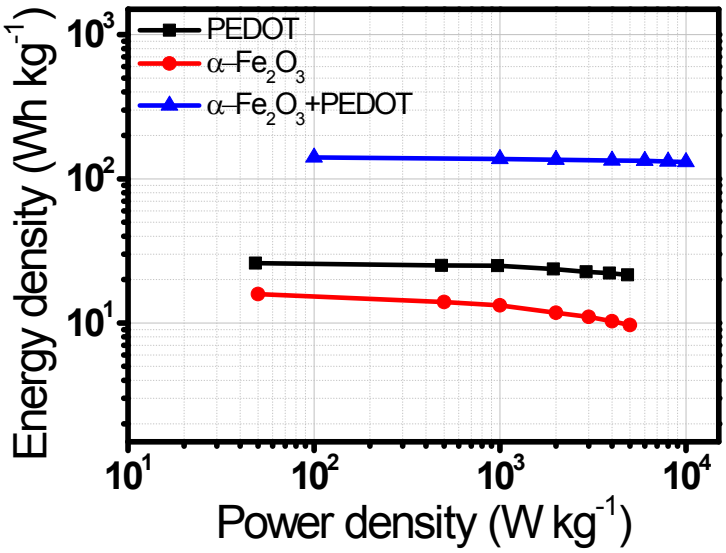

Figure S8 Ragone plots of PEDOT, α-Fe2O3, and α-Fe_2O_3+PEDOT HNPs.

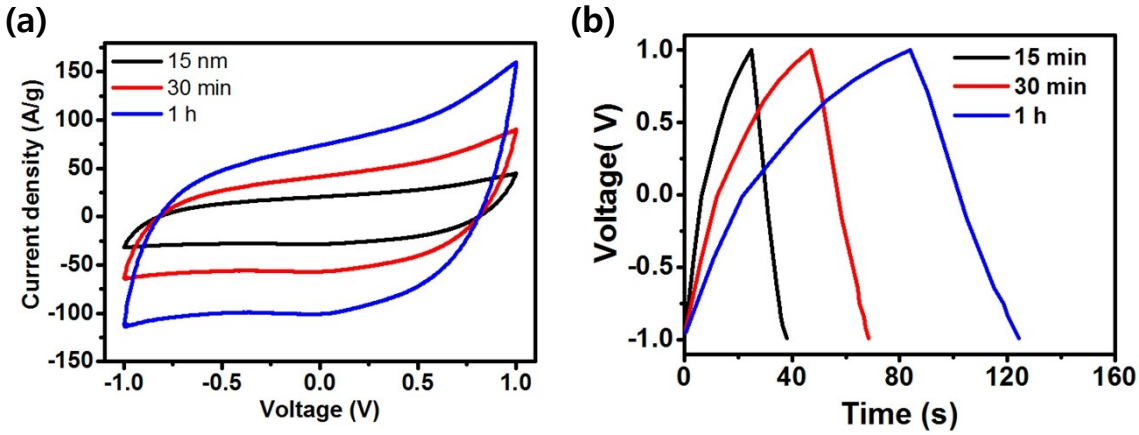

Figure S9. (a) Cyclic voltammograms at 200 mV s^{-1} scan rate and (b) galvanostatic charge-discharge curves of α-Fe_2O_3/PEDOT HNPs which made with different reaction times of FeOx through the potential window of −1.0 to 1.0 V vs. Ag/AgCl in 1 M aqueous H_2SO_4.

We evaluate the cyclic voltammetry curves and galvanostatic charge-discharge curves to investigate the supercacitive behavior (**Figure S9**). As the reaction time increased, the area under the voltammogram and the discharge time of galvanostatic curve increased, suggesting urchin-like shape FeOx NPs that has higher BET surface area demonstrated better supercapacitive performance than particle shape FeOx NPs that has lower BET surface area.

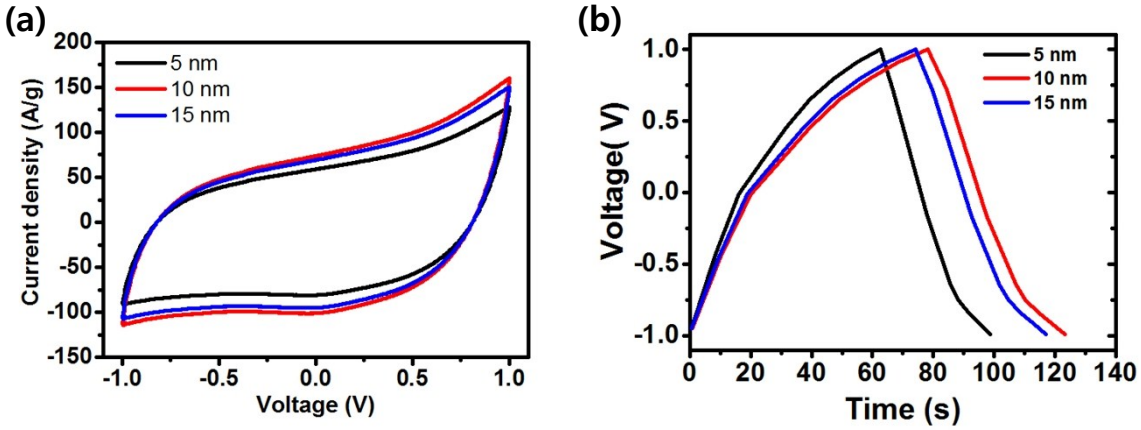

Figure S10. Cyclic voltammograms at 200 mV s^{-1} scan rate and (b) galvanostatic charge-discharge curves of α-Fe_2O_3/PEDOT HNPs which made with different shell thickness of PEDOT through the potential window of −1.0 to 1.0 V vs. Ag/AgCl in 1 M aqueous H_2SO_4.

We demonstrate the supercapatcitive performance according to the different PEDOT shell thickness of α-Fe_2O_3/PEDOT HNPs. As described in **Figure S10**, α-Fe_2O_3/PEDOT HNPs manifested the best performances at the 10 nm of PEDOT thickness. When the thickness of PEDOT increases, the electron conductivity and capacitance increases until 10 nm. But if the thickness of shell increases more than 10 nm, the aggregation of HNP appears that cause decreases the conductivity and capacitance.[S1−S2]

References

[S1] X. Xu, Q. Du, B. Peng, Q. Xiong, L. Hong, H. V. Demir, T. K. S. Wong, A. K. K. Kyaw, and X. W. Sun, *Appl. Phys. Lett.* 2014, 105, 113306.

[S2] S. Han, Y. C. Pu, L. Zheng, J. Z. Zhang, and X. Fang, *J. Mater. Chem. A*, 2015, 3, 22627−22635.