# Supporting Information

## Graphitic Carbon-Coated $FeSe_2$ Hollow Nanosphere-Decorated Reduced Graphene Oxide Hybrid Nanofibers as an Efficient Anode Material for Sodium Ion Batteries

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Keywords: iron selenide, sodium ion batteries, Kirkendall effect, graphene, carbon composite, electrospinning

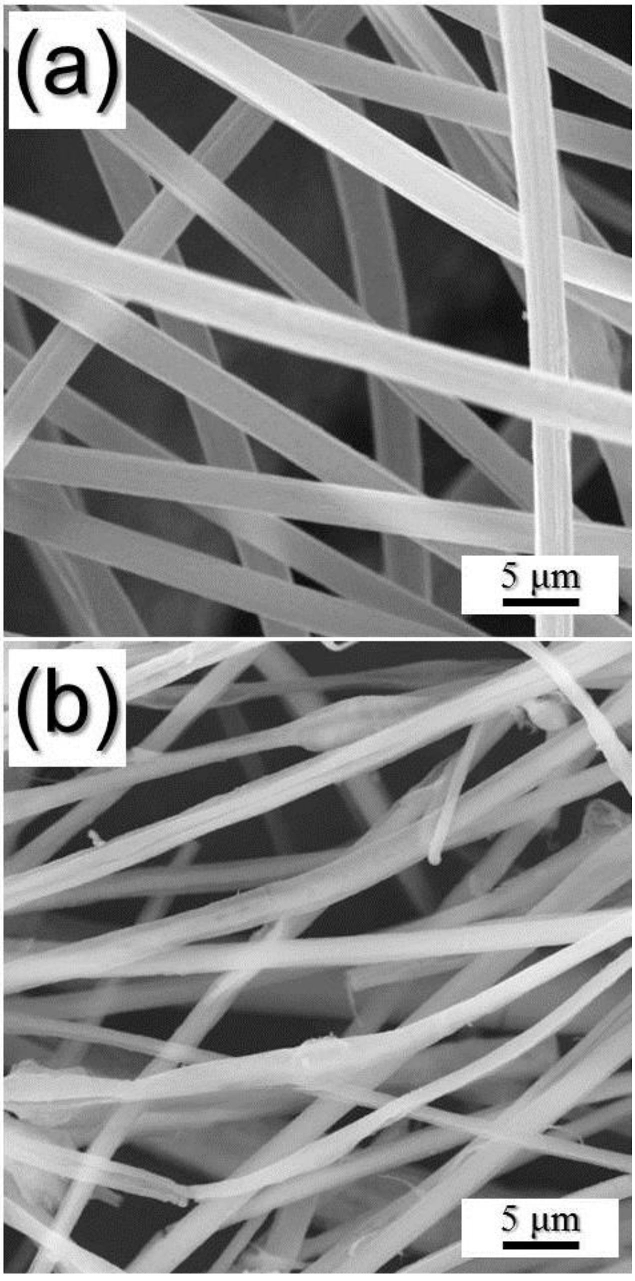



**Figure S1** SEM images of the (a) as-spun $Fe(acac)_3$–PAN–PS composite nanofibers and (b) stabilized nanofibers treated at 120 $^{o}$C under air atmosphere.

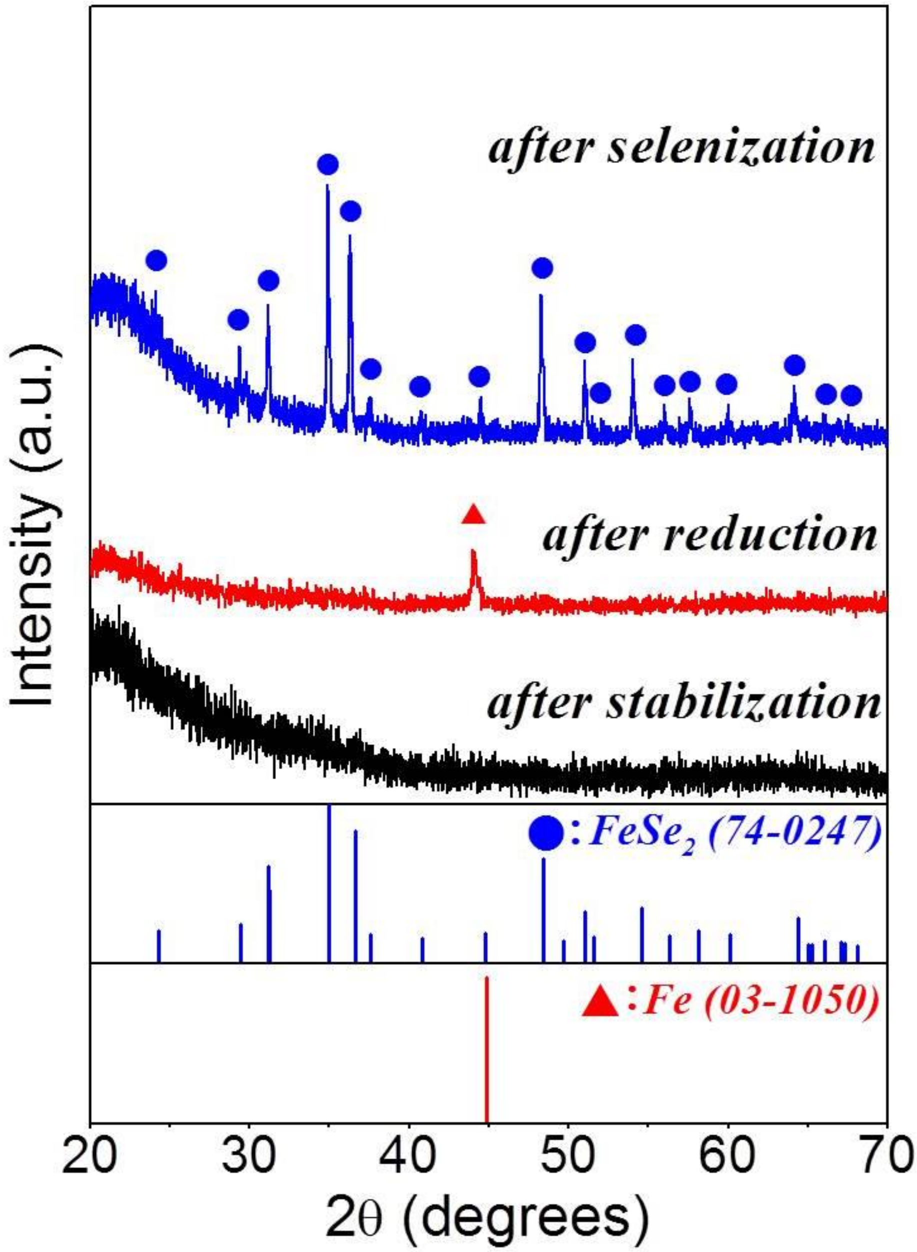



**Figure S2**. XRD patterns of the nanofibers obtained after stabilization process, subsequent reduction process, and final selenization process.

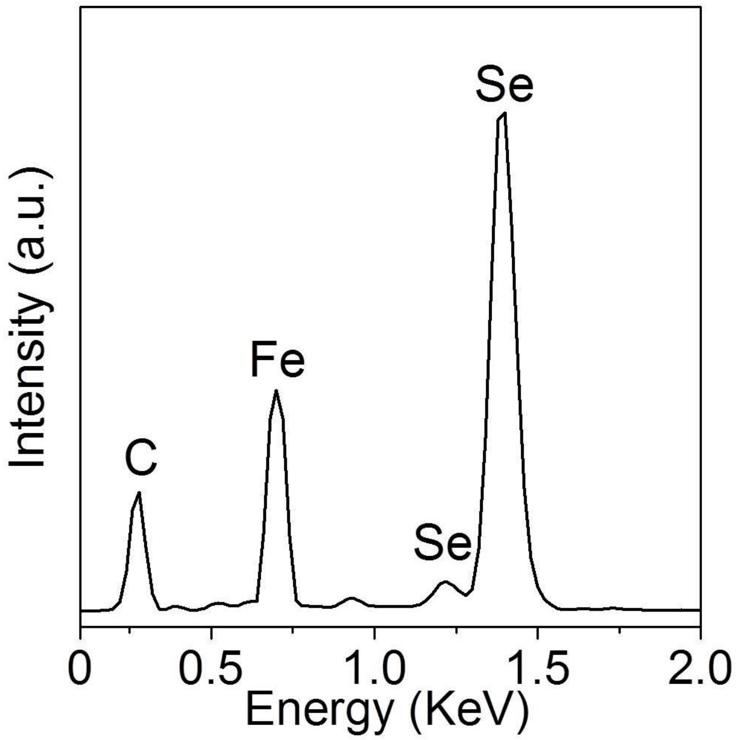



**Figure S3.** Energy dispersive spectroscopy (EDS) of the hollow nanosphere $FeSe_2$@GC–rGO hybrid nanofibers formed by selenization process.

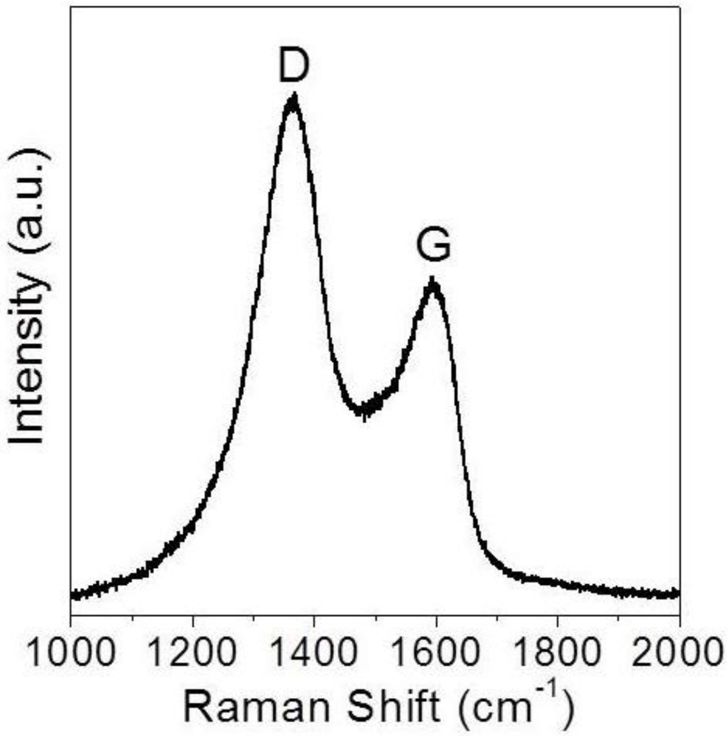



**Figure S4.** Raman spectrum of the hollow nanosphere $FeSe_2$@GC–rGO hybrid nanofibers formed by selenization process.

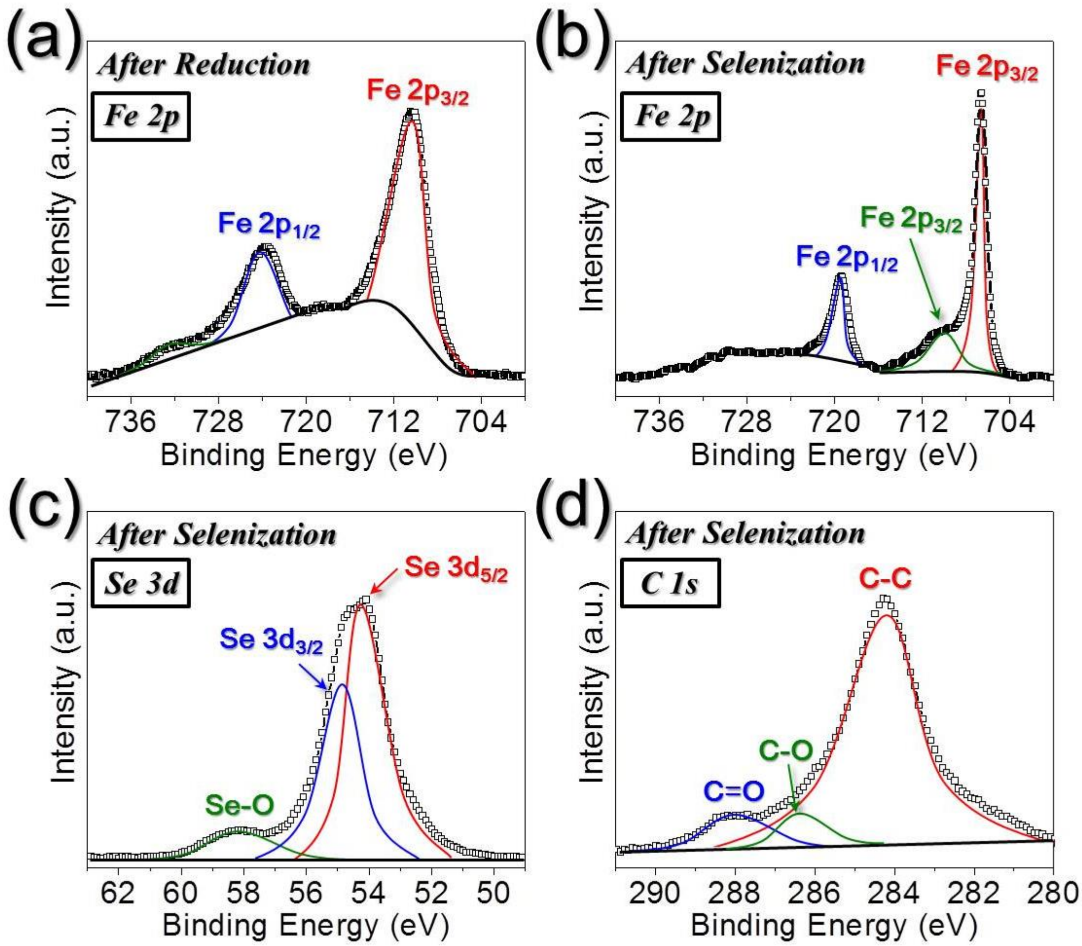



**Figure S5.** XPS spectra of the (a) Fe-rGO-GC hybrid nanofibers and (b-d) hollow nanosphere $FeSe_2$@GC–rGO hybrid nanofibers: (a,b) Fe 2p, (c) Se 3d, and (d) C 1s.

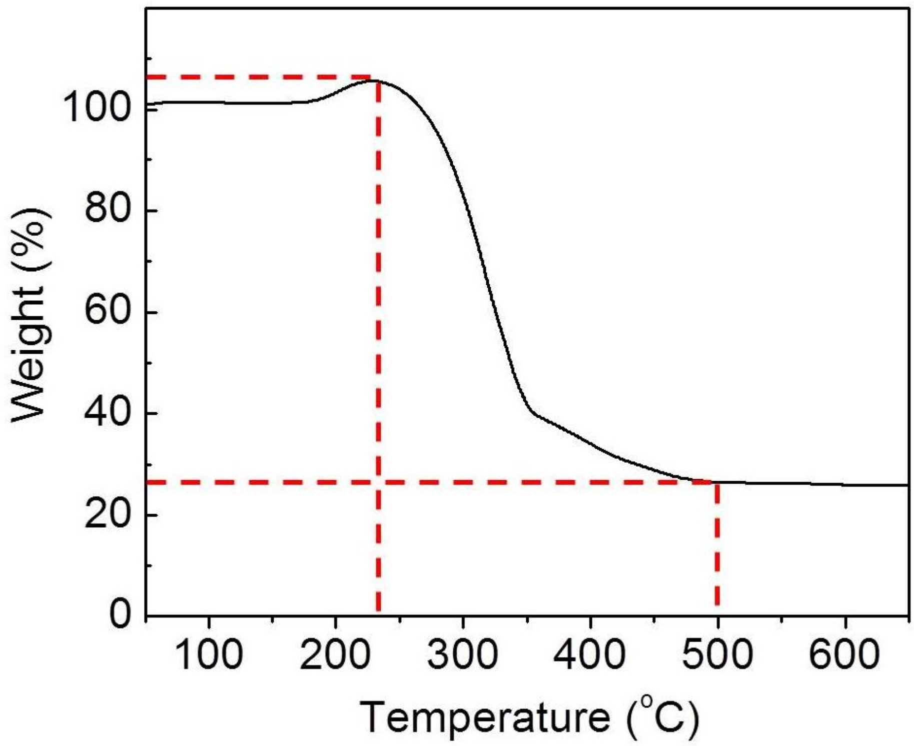



**Figure S6.** TG curve of the hollow nanosphere $FeSe_2$@GC–rGO hybrid nanofibers obtained after selenization process.

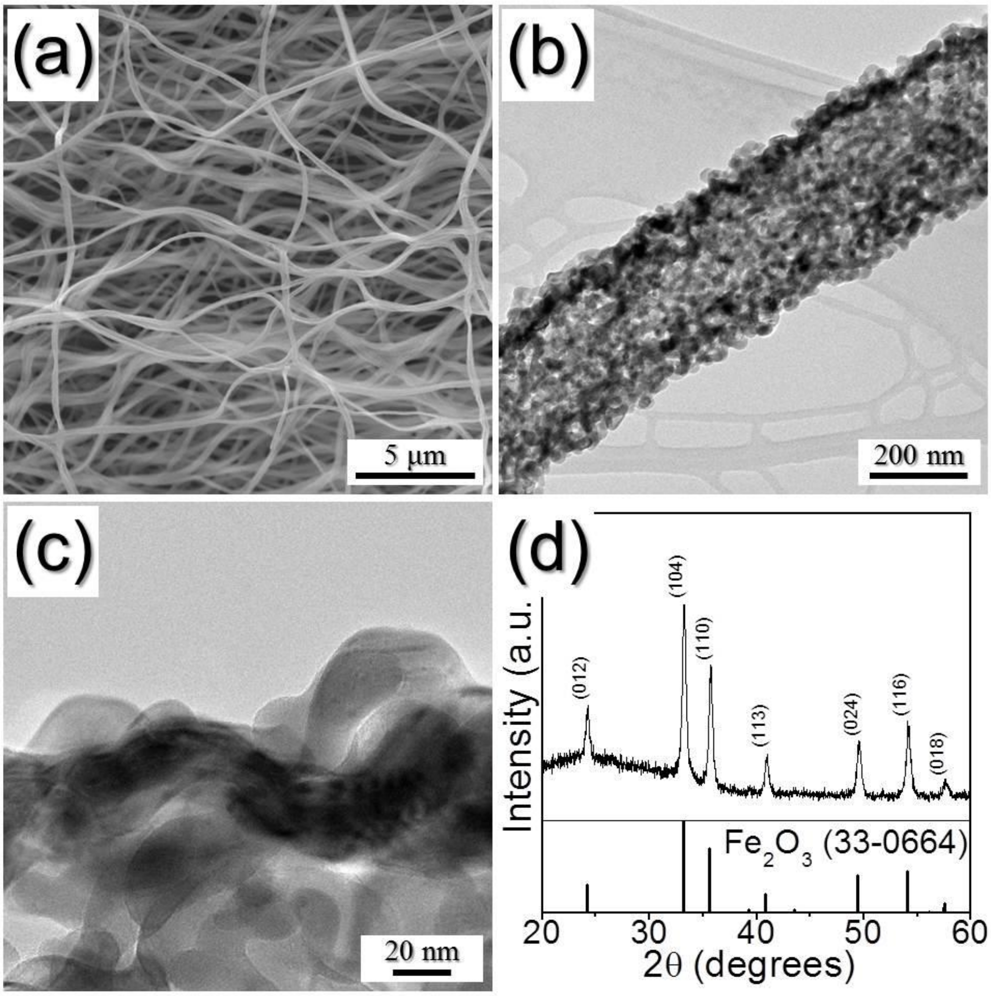



**Figure S7.** Morphologies and XRD pattern of the bare $Fe_2O_3$ nanofibers obtained after oxidation process of the $Fe(acac)_3$–PAN-PS composite nanofibers under air atmosphere at 500 $^oC$: (a) SEM image, (b,c) TEM images, and (d) XRD pattern.

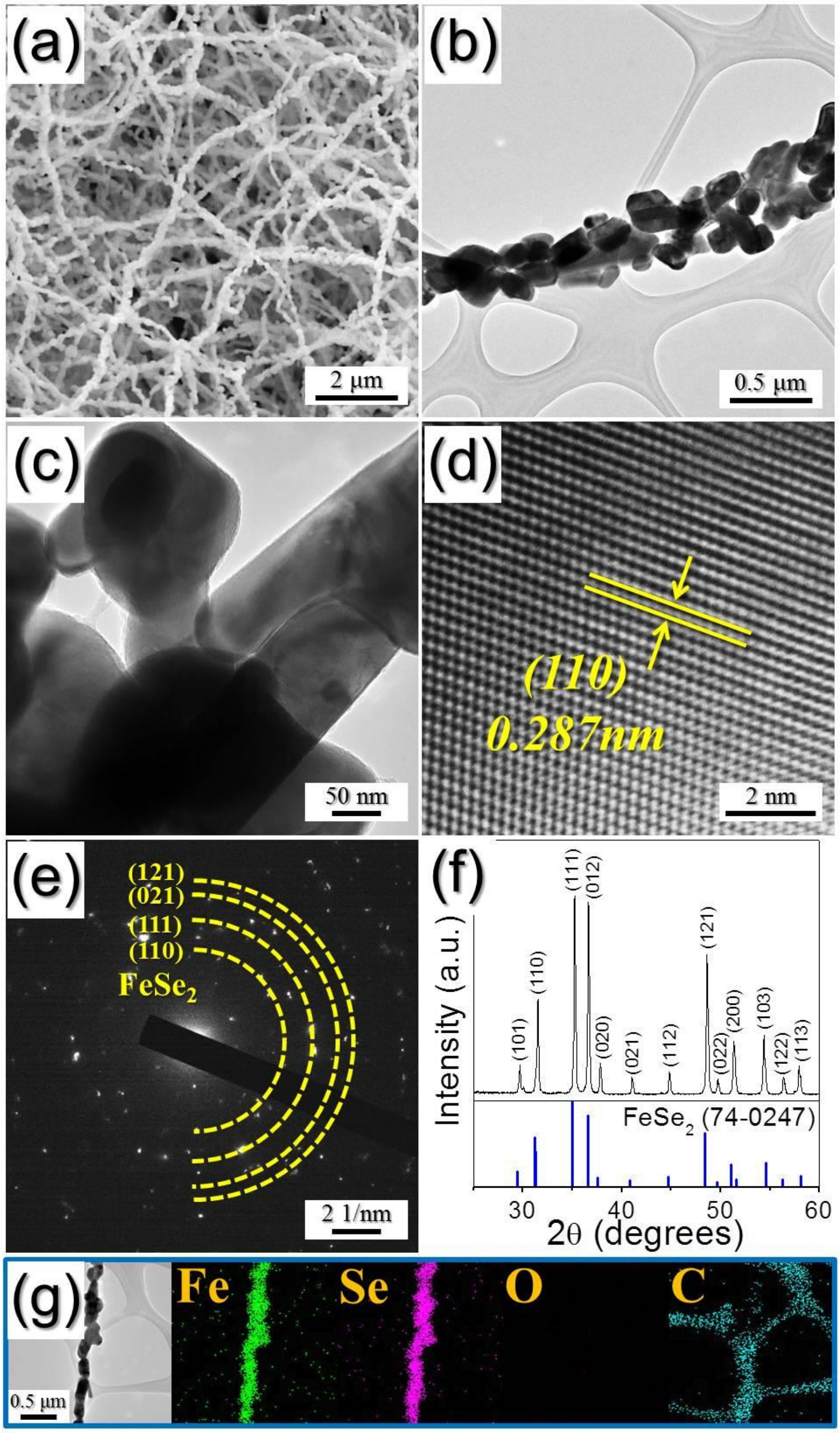



**Figure S8.** Morphologies, SAED pattern, XRD pattern, and elemental mapping images of the bare $FeSe_2$ nanofibers: (a) SEM, (b,c) TEM images, (d) HR-TEM image, (e) SAED pattern, (f) XRD pattern, and (g) elemental mapping images.

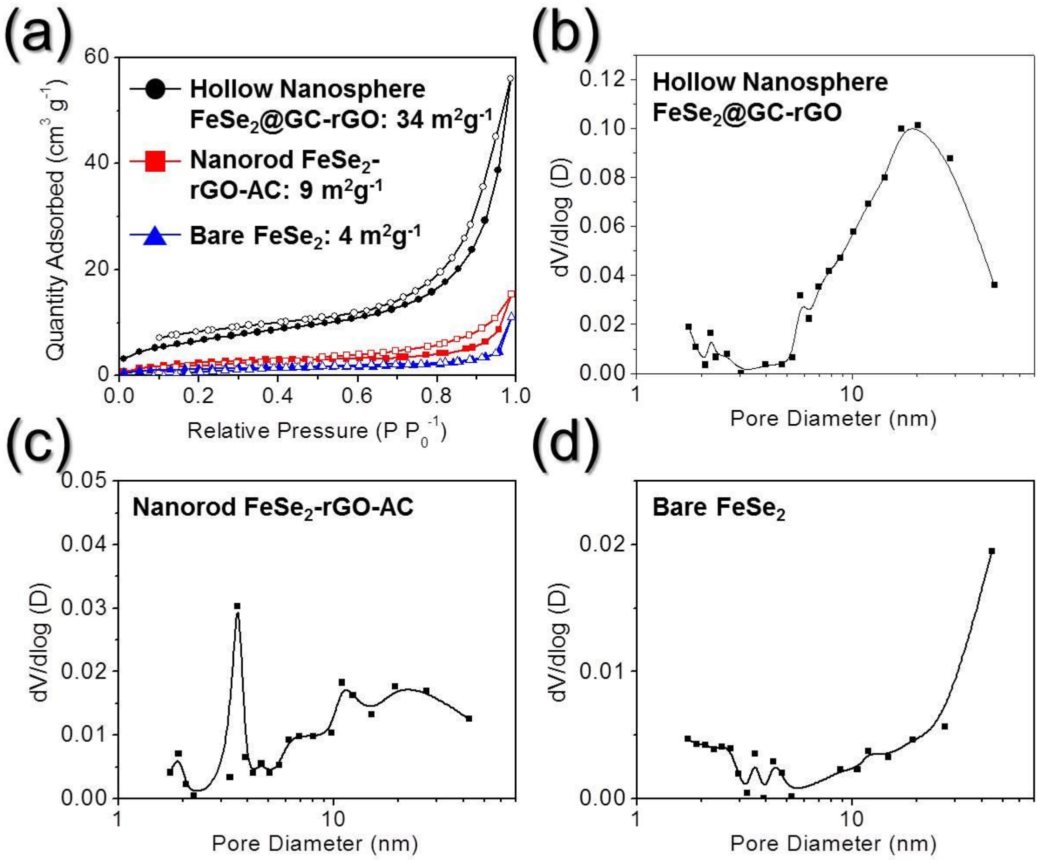



**Figure S9.** (a) $N_2$ gas adsorption and desorption isotherms and pore size distributions of (b) hollow nanosphere $FeSe_2$@GC–rGO hybrid nanofibers, (c) nanorod $FeSe_2$-rGO-AC hybrid nanofibers, and (d) bare $FeSe_2$ nanofibers.

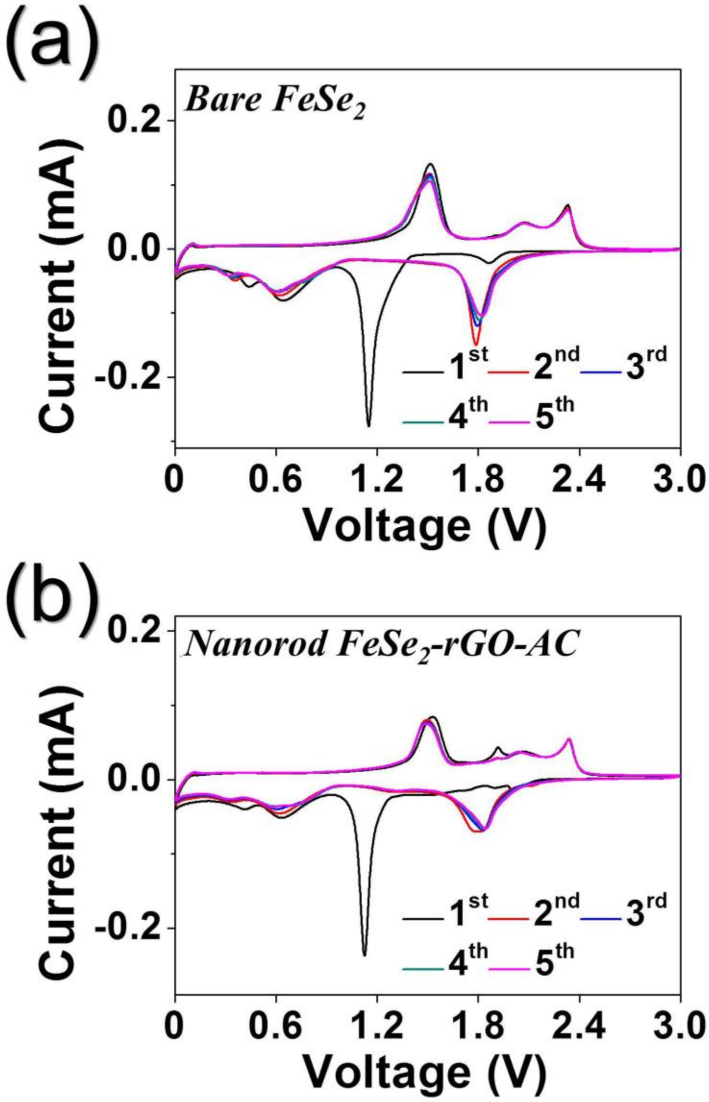



**Figure S10.** CV curves of the (a) nanorod $FeSe_2$-rGO-AC hybrid nanofibers and (b) bare $FeSe_2$ nanofibers.

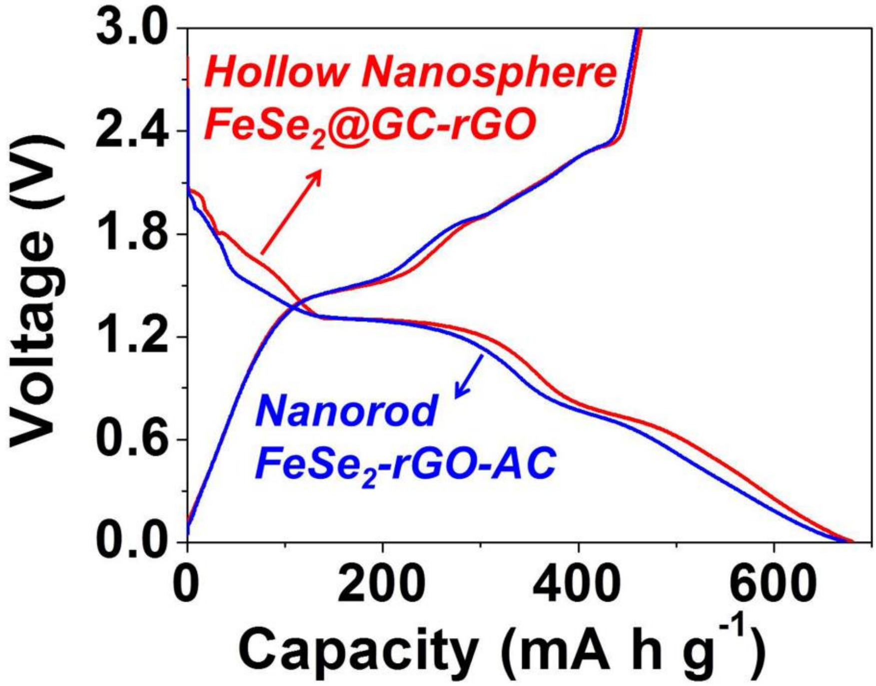
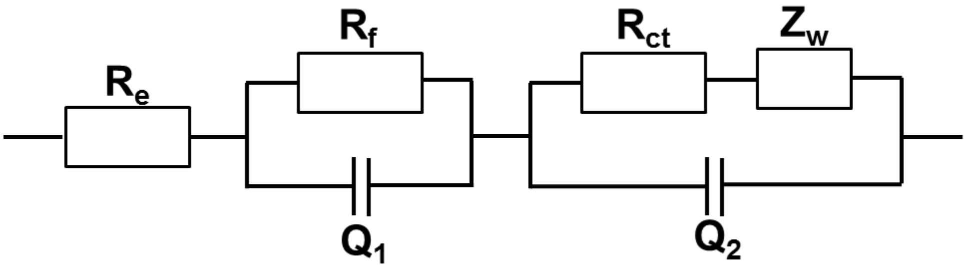



**Figure S11**. First charge-discharge curves of the hollow nanosphere $FeSe_2$@GC–rGO hybrid nanofibers and nanorod $FeSe_2$-rGO-AC hybrid nanofibers at a current density of 50 mA $g^{-1}$.




$R_e$ : the electrolyte resistance, corresponding to the intercept of high frequency semicircle at $Z_{re}$ axis

$R_f$ : the SEI layer resistance corresponding to the high-frequency semicircle

$Q_1$ : the dielectric relaxation capacitance corresponding to the high-frequency semicircle

$R_{ct}$: the denote the charger transfer resistance related to the middle-frequency semicircle

$Q_2$ : the associated double-layer capacitance related to the middle-frequency semicircle

$Z_w$ : the Na-ion diffusion resistance

**Figure S12.** Randle-type equivalent circuit model used for AC impedance fitting.