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

Supporting Information

Rationally Designed Microspheres Consisting of Yolk–Shell Structured $FeSe_2$-Fe_2O_3 Nanospheres Covered with Graphitic Carbon for Lithium-ion Batteries

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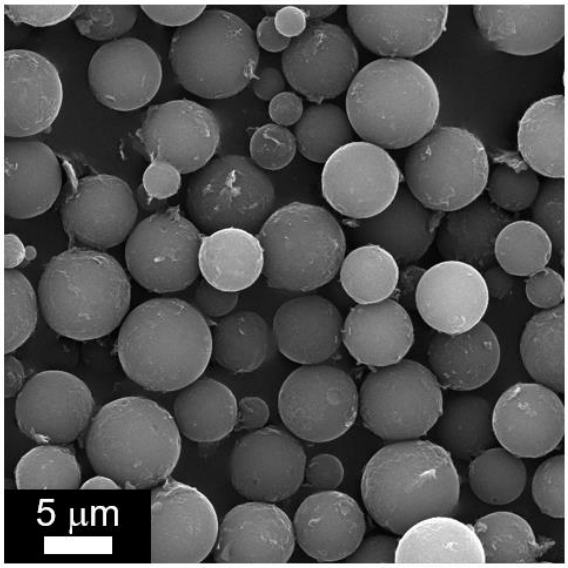

Fig. S1 SEM image of AC microspheres impregnated with ferric nitrate.

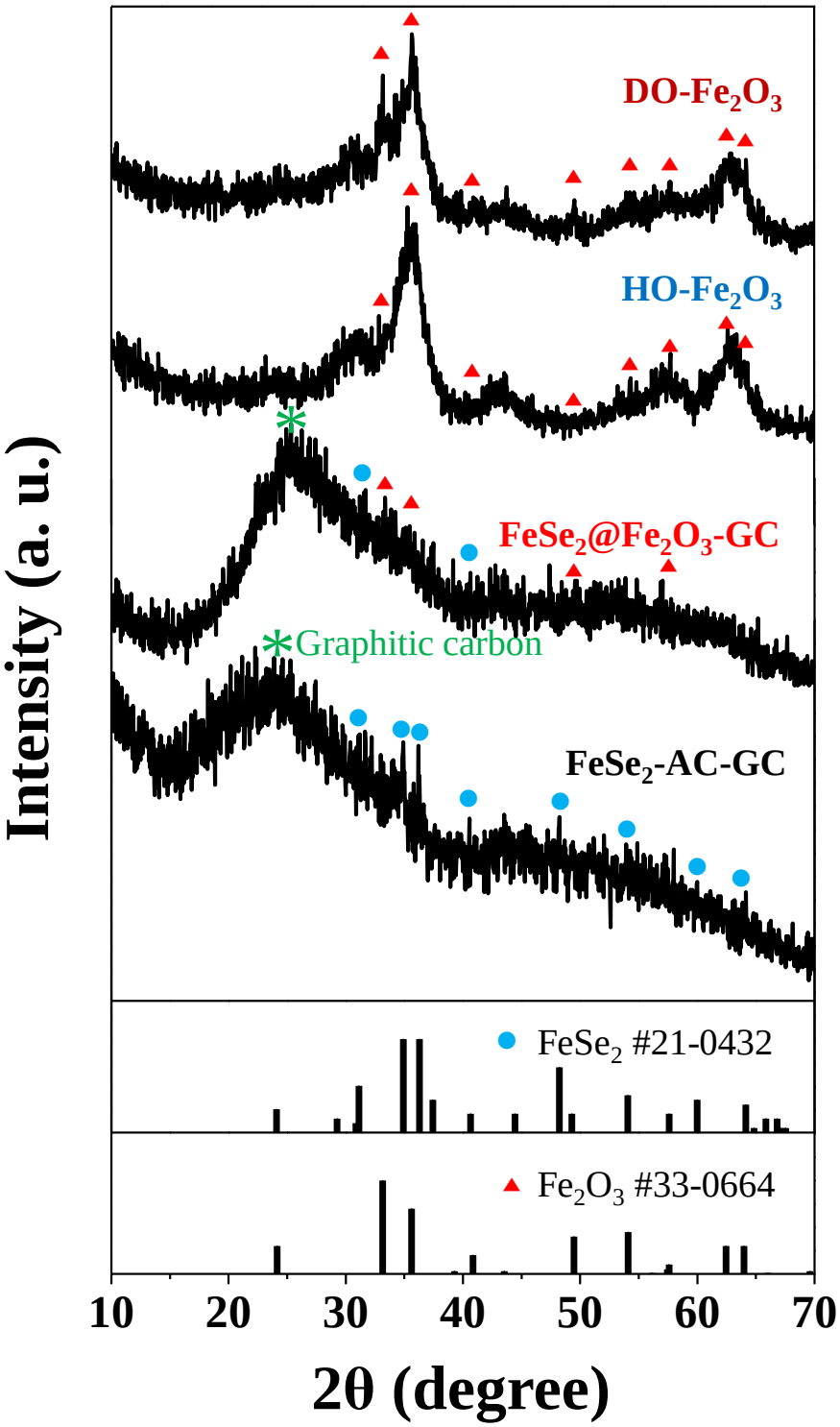

Fig. S2 XRD patterns of $FeSe_2$-GC-AC, $FeSe_2@Fe_2O_3$-GC, HO-Fe_2O_3, and DO-Fe_2O_3 microspheres.

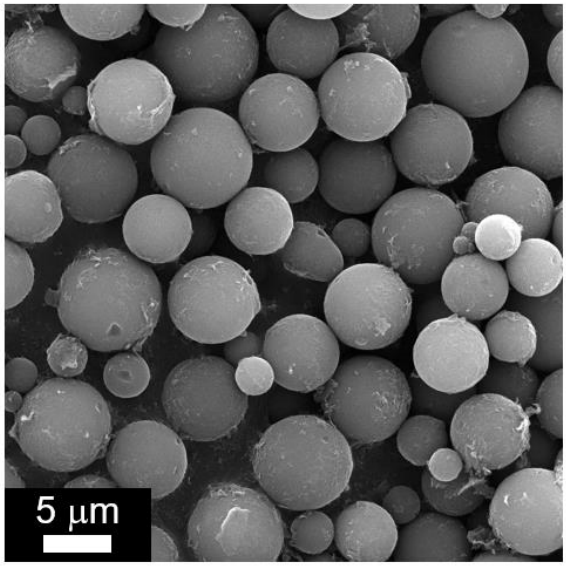

Fig. S3 SEM image of $FeSe_2$-GC-AC composite microspheres.

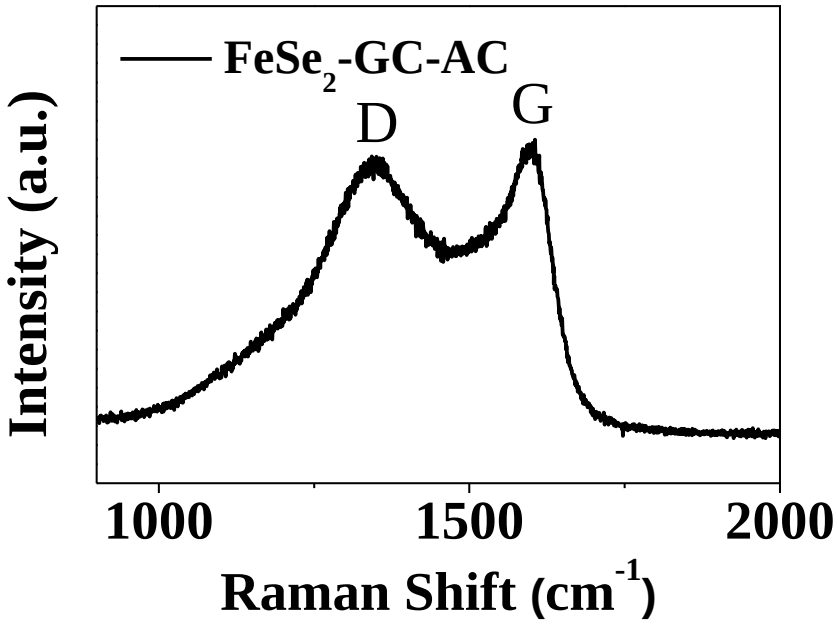

Fig. S4 Raman spectrum of $FeSe_2$-GC-AC microspheres.

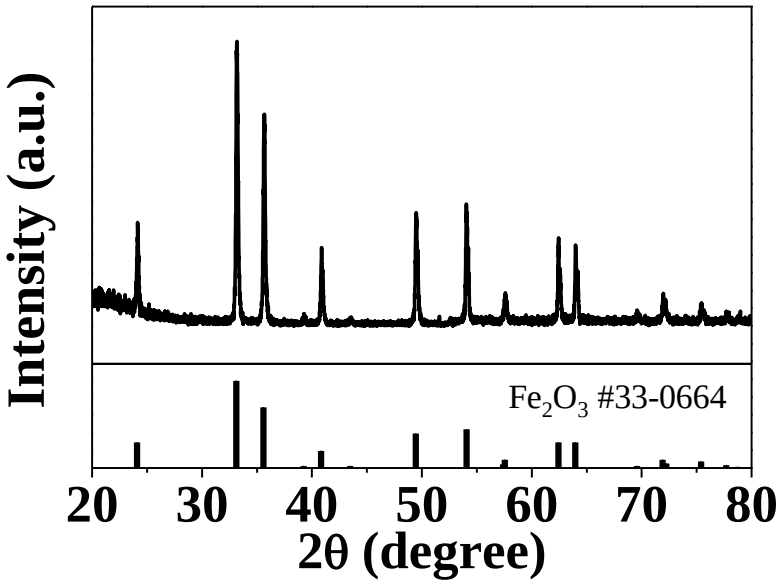

Fig. S5 XRD pattern of Fe_2O_3 powders obtained after oxidation process of $FeSe_2$@Fe_2O_3-GC at 600 ^oC for 3 h.

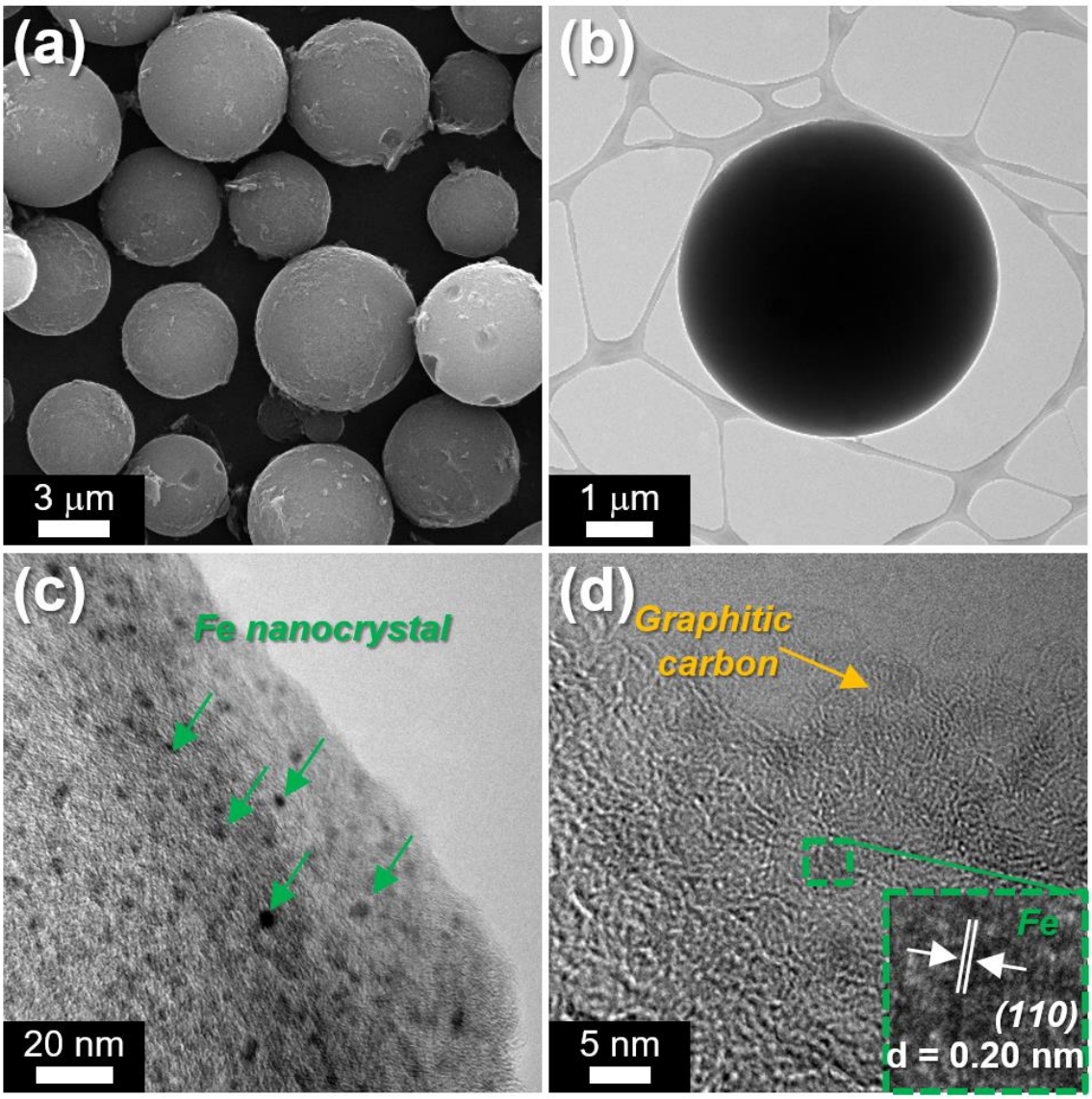

Fig. S6 Morphologies of Fe-GC-AC composite microspheres: (a) SEM image, (b,c) TEM images, and (d) HR-TEM image.

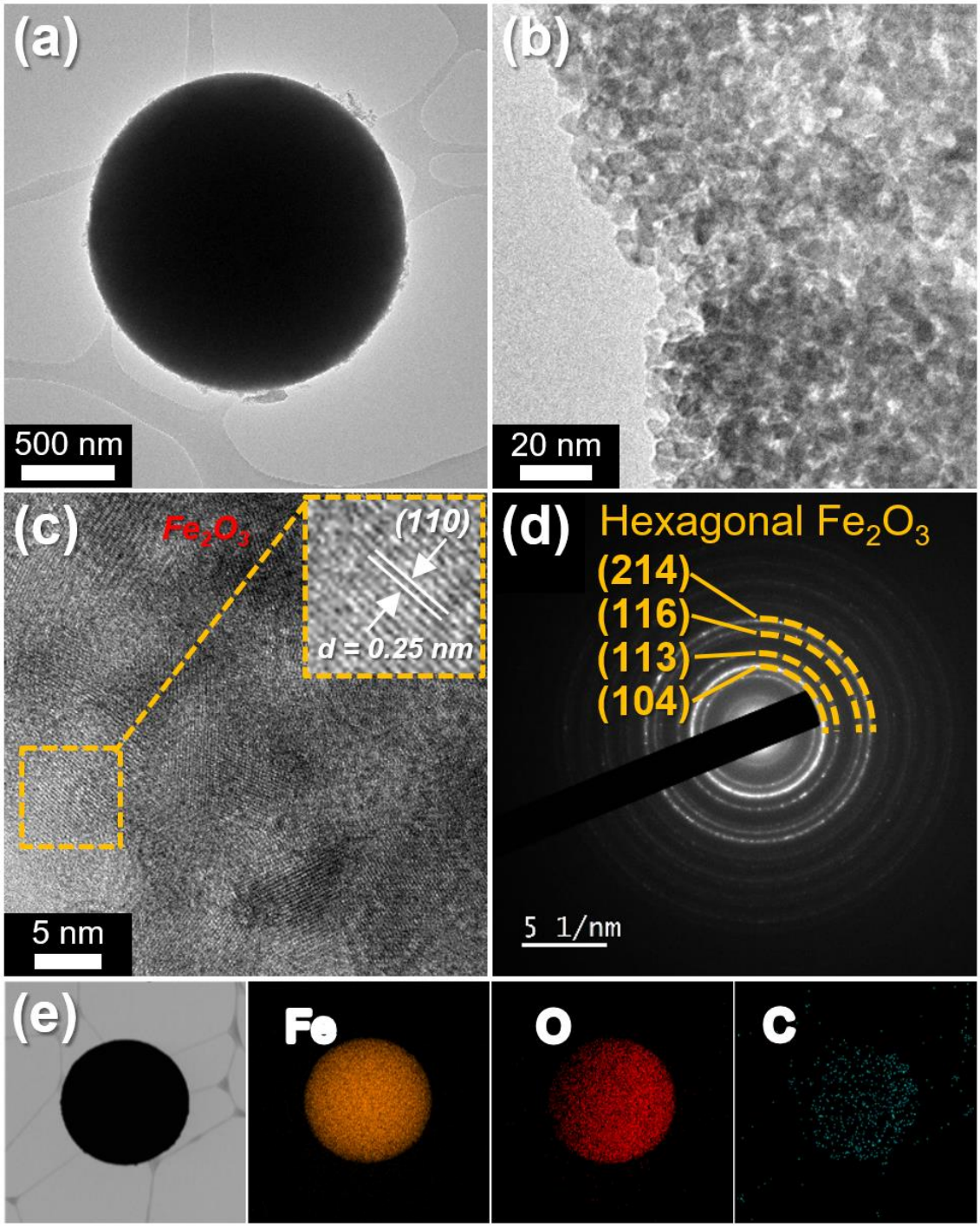

Fig. S7 Morphologies of DO-Fe_2O_3 microspheres: (a,b) TEM images, (c) HR-TEM image, (d) SAED pattern, and (e) elemental mapping images.

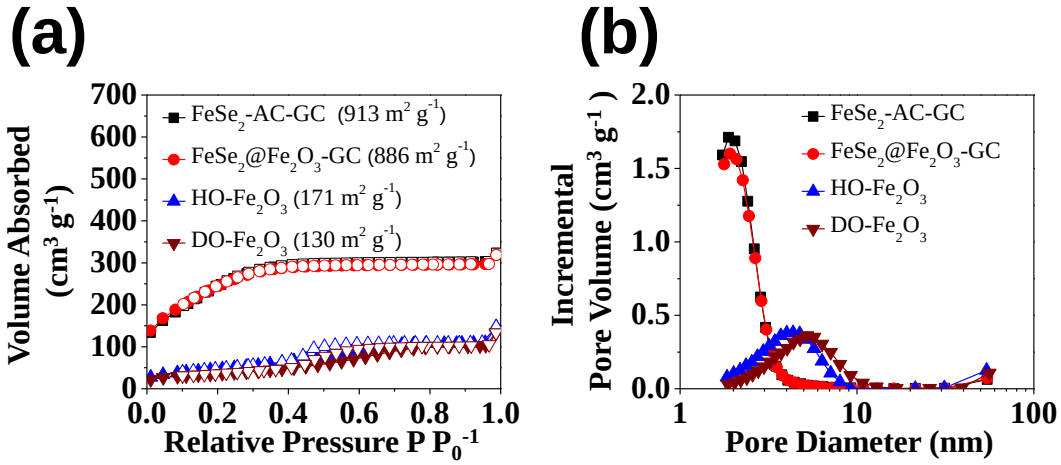

Fig. S8 (a) N_2 adsorption and desorption isotherms curves and (b) BJH pore size distributions of $FeSe_2$-GC-AC, $FeSe_2$-Fe_2O_3-GC, HO-Fe_2O_3, and DO-Fe_2O_3 microspheres.

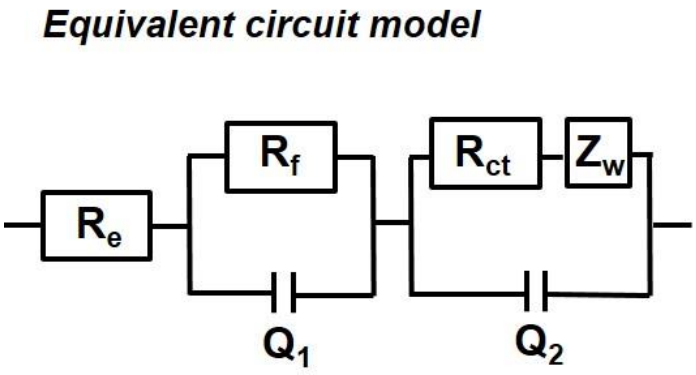

Fig. S9 Randle-type equivalent circuit model used for EIS fitting.

R_e: the electrolyte resistance, corresponding to the intercept of high frequency semicircle at Z': real 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 Li-ion diffusion resistance

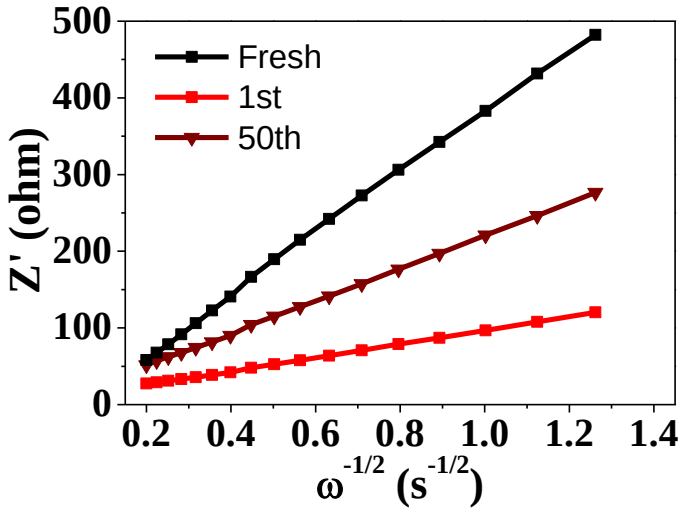

Fig. S10 Real impedance (Z') *vs.* Reciprocal root square of the angular frequency ($\omega^{-1/2}$) plots in low frequency of $FeSe_2$@Fe_2O_3-GC electrodes before and after cycles.

Table S1. Carbon contents of $FeSe_2@Fe_2O_3$-GC, $FeSe_2$-GC-AC, HO-Fe_2O_3 and DO-Fe_2O_3 microspheres.

Active material	**Carbon content (wt%)**
$FeSe_2@Fe_2O_3$-GC	52.2
$FeSe_2$-GC-AC	80.5
HO- Fe_2O_3	0
DO- Fe_2O_3	0