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Mesoporous Graphitic Carbon Microspheres with Controlled Amount of Amorphous Carbon as Efficient Se Host Material for Li-Se Batteries

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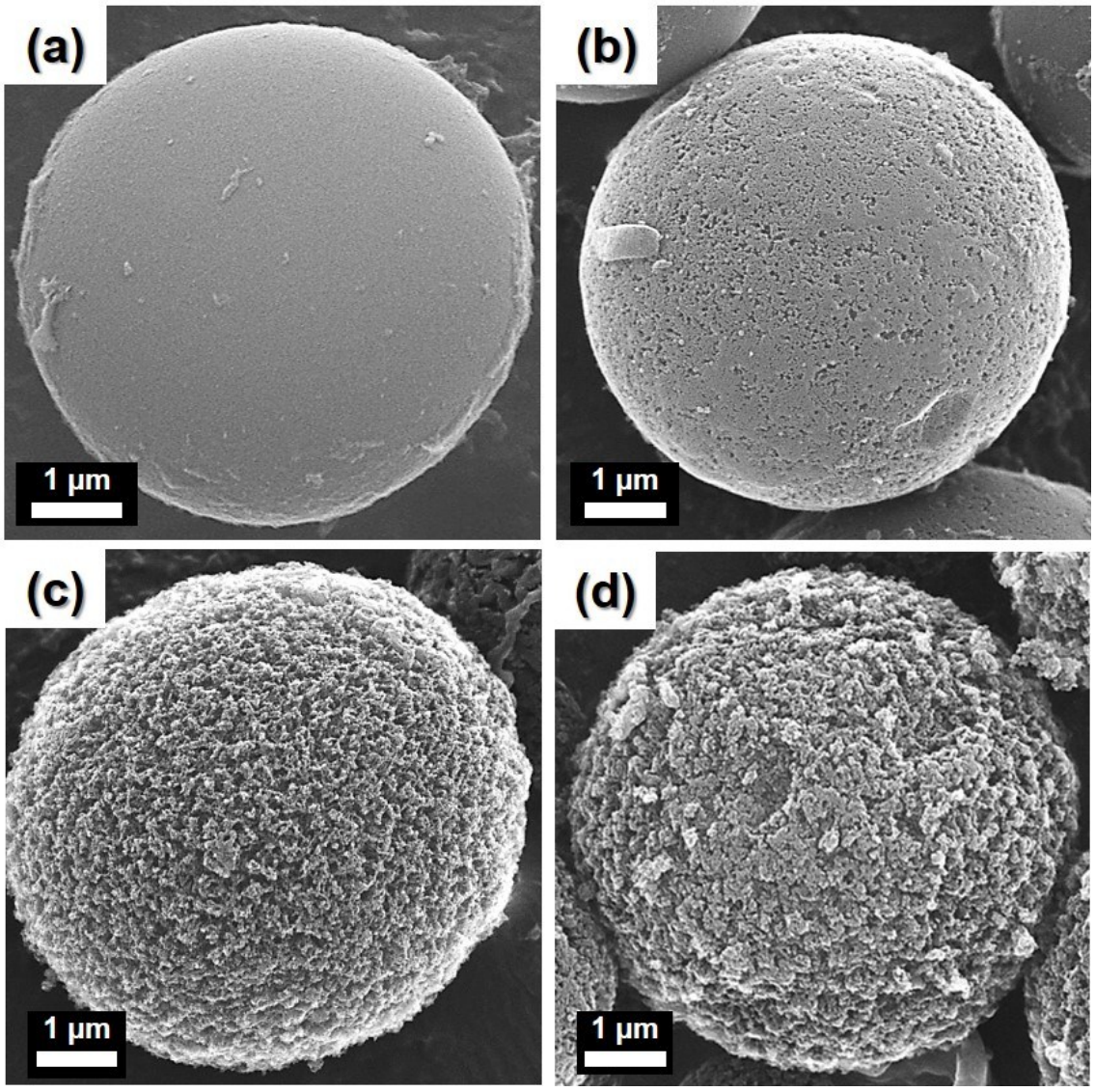

Fig. S1. SEM images of (a) AC, (b) GC-AC-Fe-TiO, (c) GC-Fe-Fe_2O_3-TiO and (d) GC-TiO microspheres.

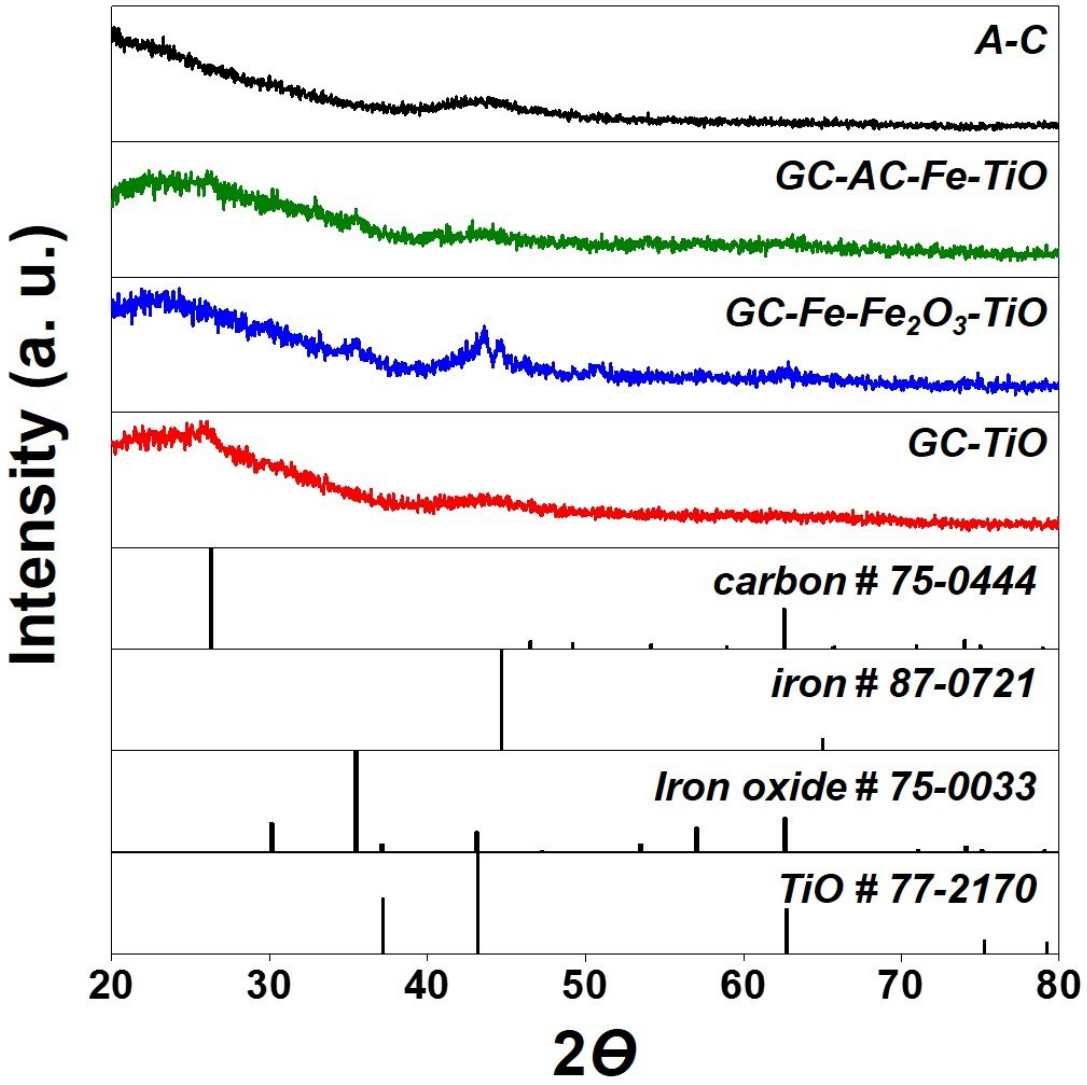

Fig. S2. XRD patterns of (a) A-C, (b) GC-AC-Fe-TiO, (c) GC-Fe-Fe_2O_3-TiO and (d) GC-TiO microspheres.

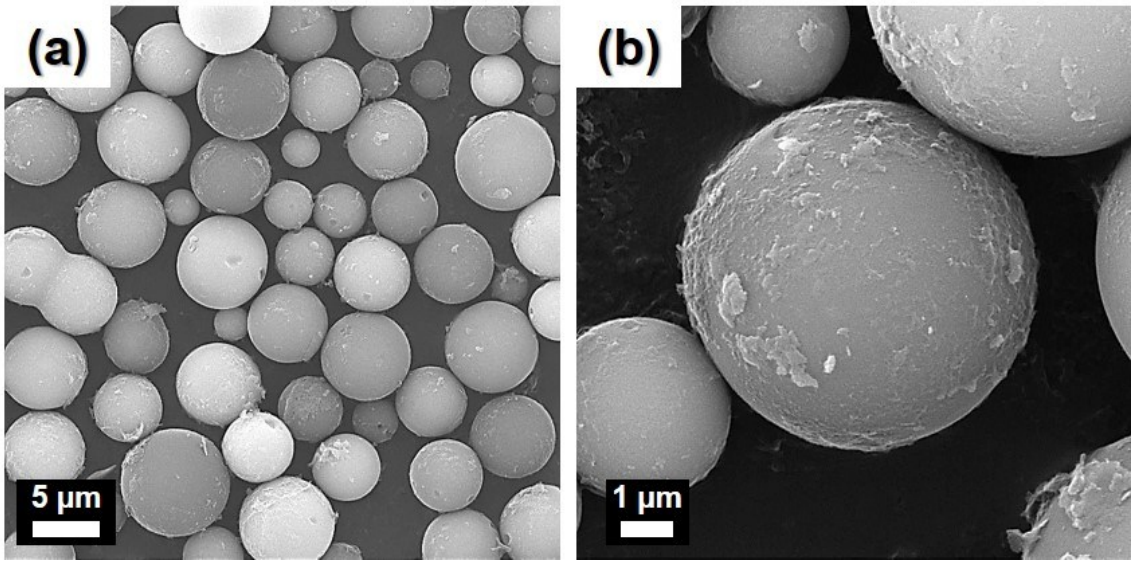

Fig. S3. SEM images of A-C/Se microspheres.

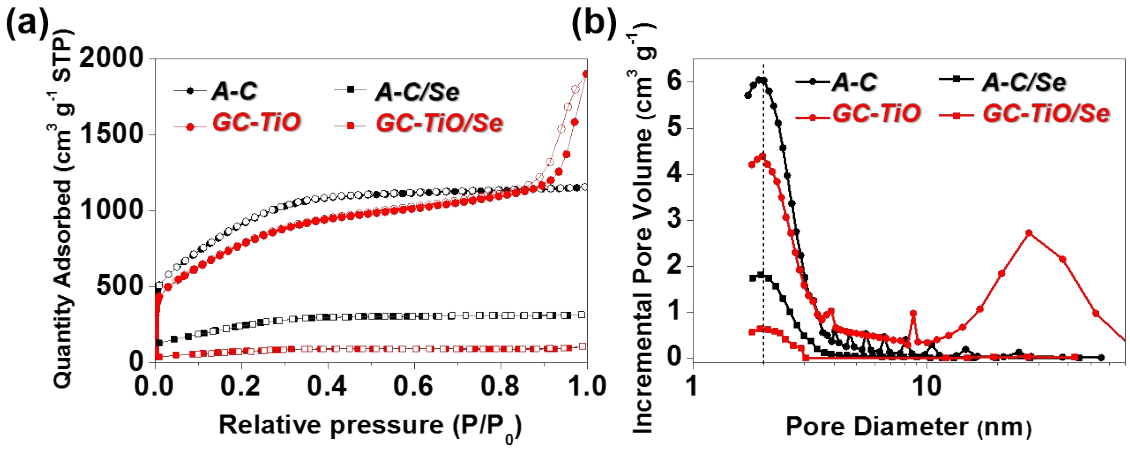

Fig. S4. N_2 gas adsorption and desorption isotherms and the BJH pore size distributions of GC-TiO and A-C microspheres before and after Se infiltration measured by the TriStar 3000 analyzer.

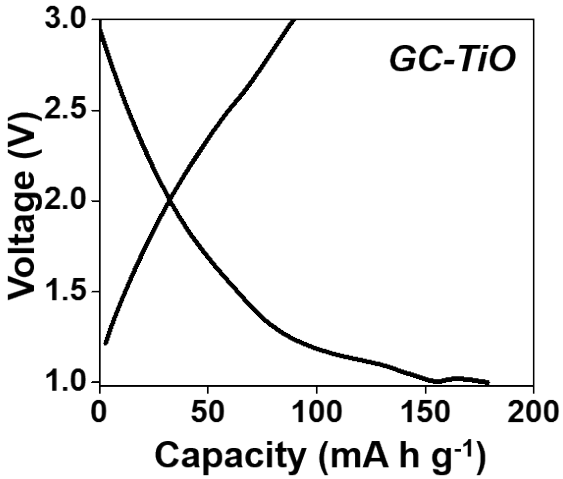

Fig. S5. Initial discharge and charge curves of GC-TiO microspheres without Se at a current density of 0.5 C.

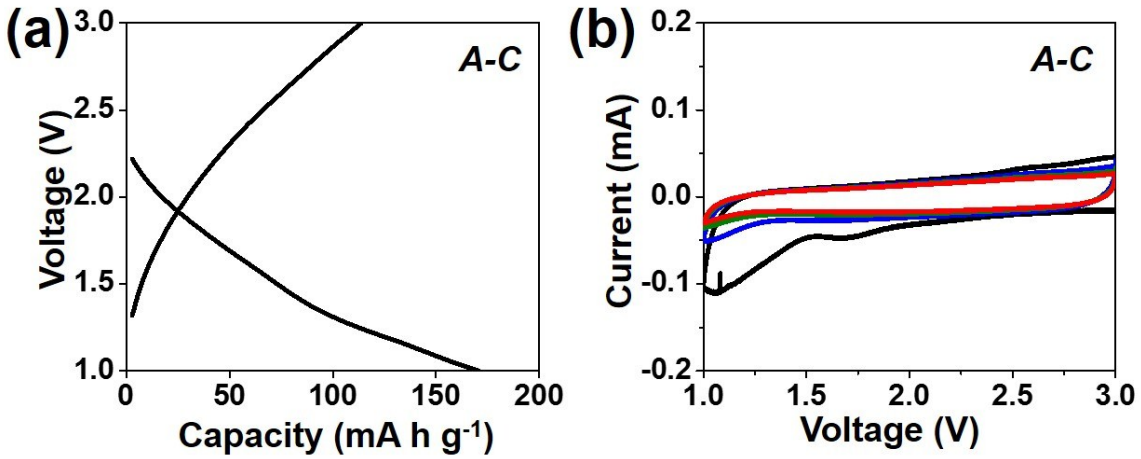

Fig. S6. (a) Initial discharge and charge curves and (b) Cyclic voltammetry (CV) curves of A-C microspheres.

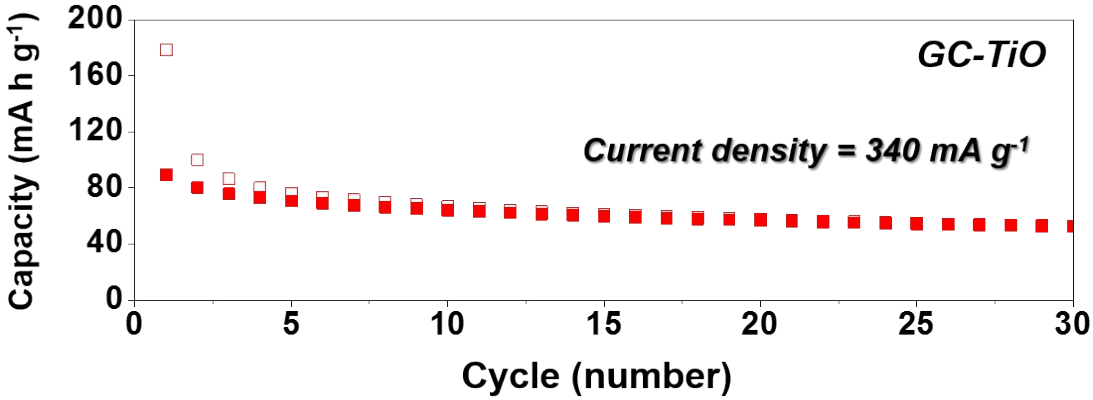

Fig. S7. Cycling performance of GC-TiO microspheres without Se at a current density of 0.5 C.

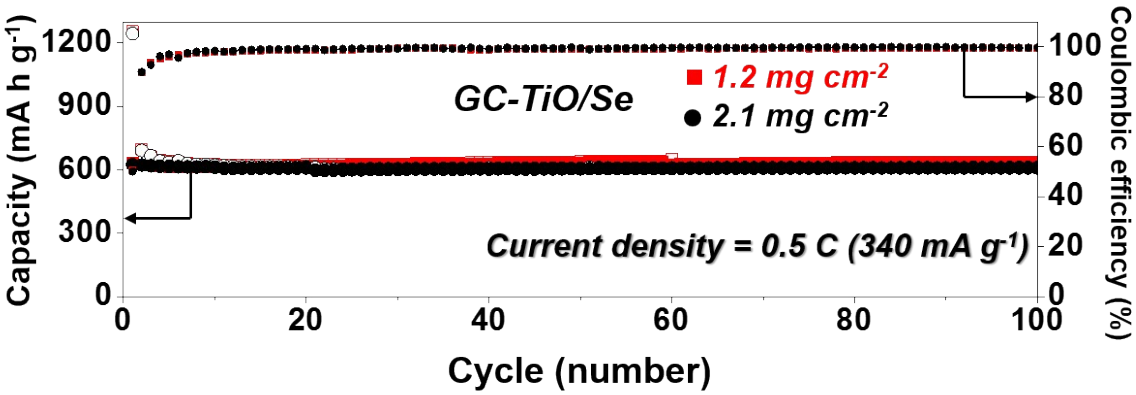

Fig. S8. Effect of loading rate of cathode material on cycling performance of GC-TiO/Se electrode at a current density 0.5 C.

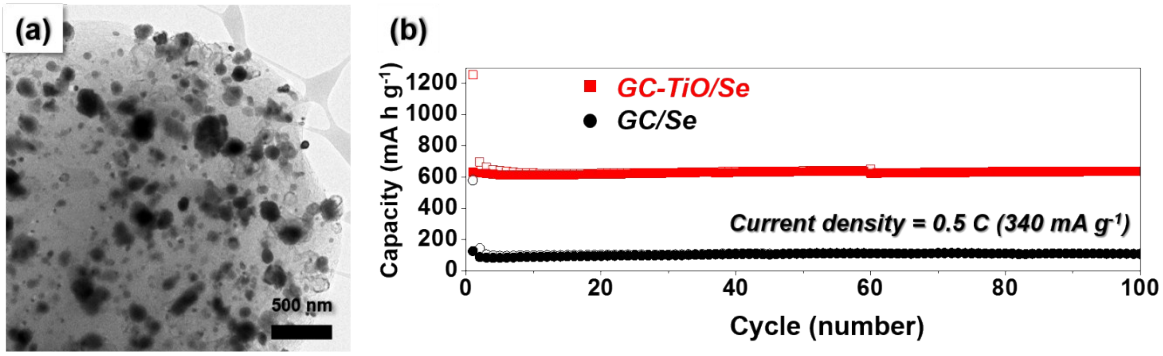

Fig. S9. Morphologies of (a) Fe-AC-GC microspheres and (b) cycling performances of GC-TiO/Se and GC/Se microspheres at a constant current of 0.5 C.

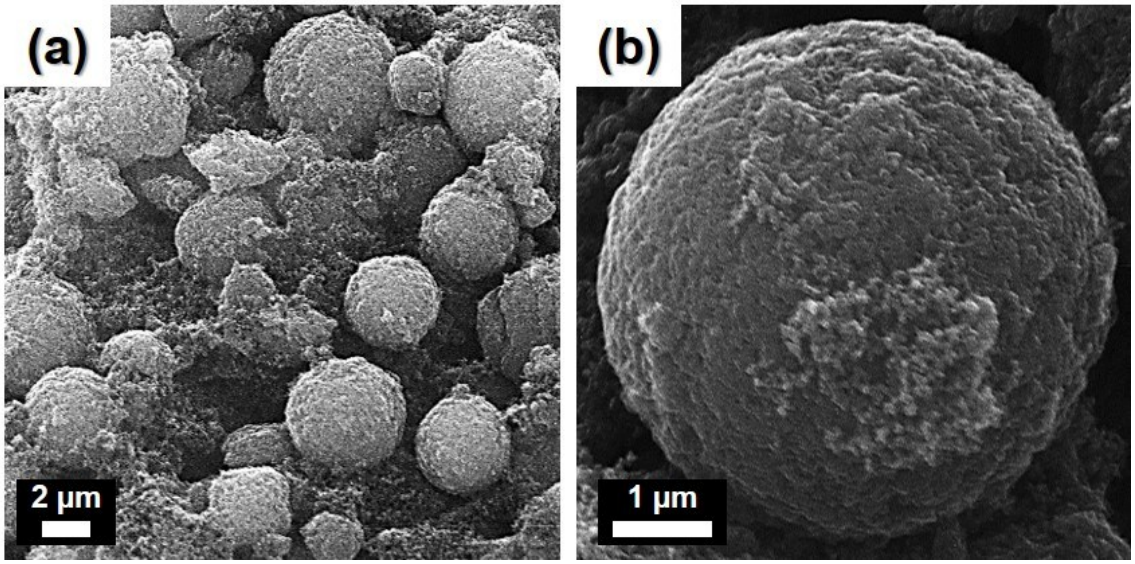

Fig. S10. Morphology of GC-TiO/Se microspheres obtained after 100 cycles.

Table S1. Electrochemical properties of various nanostructured materials applied as lithium-selenium batteries reported in the previous literatures.

Morphology [preparation method]	Se content (%)	Current density	Initial discharge/charge capcities [mA h g^{-1}]	Discharge capacity [mA h g^{-1}] and (cycle number)	Rate capacity [mA h g^{-1}]	Ref.
GC-TiO/Se composite microsphere [“drop and drying” & two-step post-treatment]	**70**	**0.5 C**	**1266/665**	**584 (850)**	**435 (10 C)**	***This work***
Nitrogen-containing hierarchical porous carbon [template-assisted]	56.2	2 C	435/~314	305 (60)	~246 (5 C)	S1
Macro-/micro-porous biochar-based framework [carbonizaion of pomelo]	56.1	0.2 C	877.2/597.4	467 (300)	421 (2 C)	S2
Porous hollow carbon bubbles [hydrothermal]	~50	0.1 C	691.1/454.6	606.3 (120)	431.9 (1 C)	S3
Graphene–encapsulated selenium / polyaniline core–shell nanowires [*in situ* chemical oxidative polymerization]	~59.7	0.1 C	917/~708	540 (100)	430 (5 C)	S4
Metal complex-derived porous carbon [salt-bake approach]	72	0.1 C	904/~635	636 (150)	547 (10 C)	S5
Porous carbon nanofiber webs [modified oxidative template assembly]	33.2	1 C	439/-	323.7 (300)	345.6 (1 C)	S6
Mesoporous carbon microsphere [spray drying]	50	0.5 C	513/-	300 (100)	320 (5 C)	S7
3D mesoporous carbon [heating melt-infiltration]	62	0.1 C (first 5 cycles)1 C	655/- 432/-	385 (1300)	274 (3C)	S8
Carbon bonded and encapsulated selenium composites [*in situ* carbonization]	54	100 mA g^{-1}	862/560	430 (250)	280 (1200 mA g^{-1})	S9
Heteroatom-doped microporous carbon [carbonization of polypyrrole with KOH]	60	1 C	~1200/664	506 (150)	303 (20 C)	S10

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