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Electronic Supplementary Information (ESI)

TiO_2-rGO nanocomposite hollow spheres: Large scale synthesis and application as an efficient anode material for lithium-ion batteries

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Supporting Figures

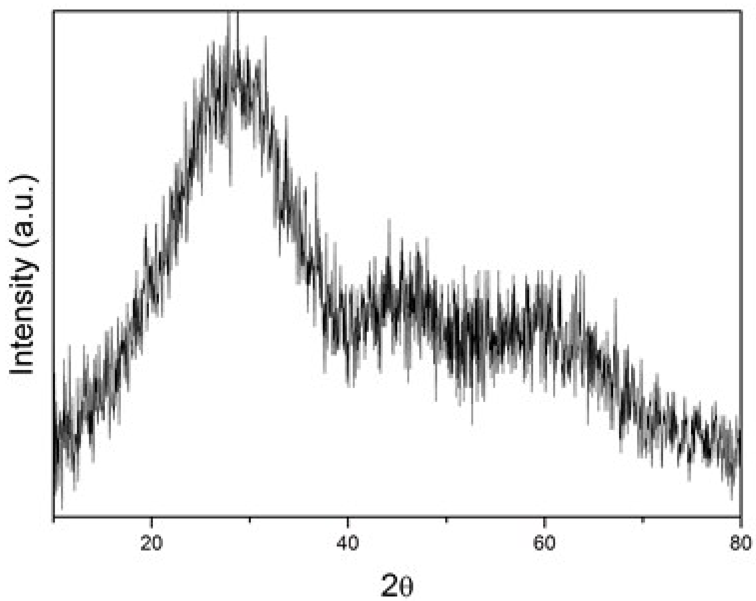


Fig. S1 XRD pattern of as-spray dried titanium based material with 10% GO.

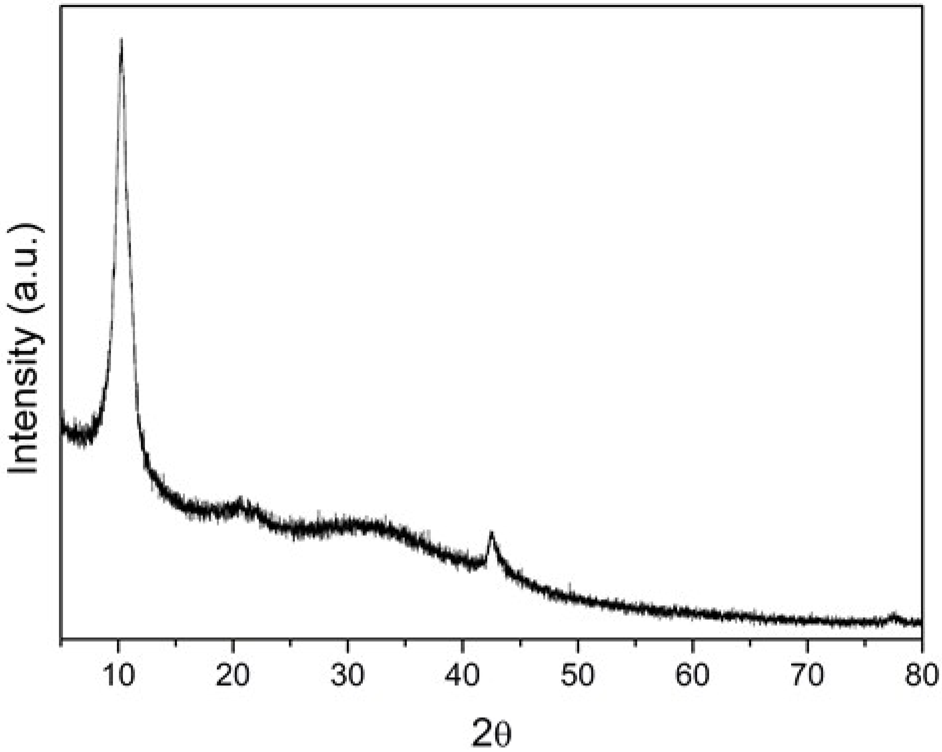


Fig. S2 XRD pattern of pure GO.

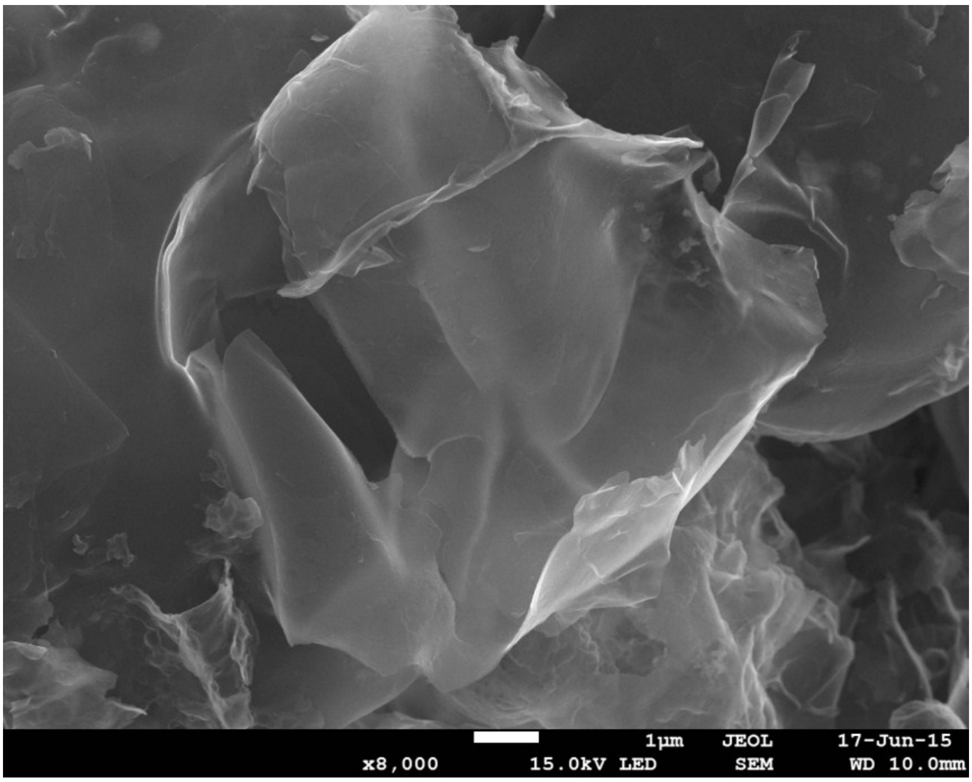


Fig. S3 SEM image of calcined TiO_2-pristine.

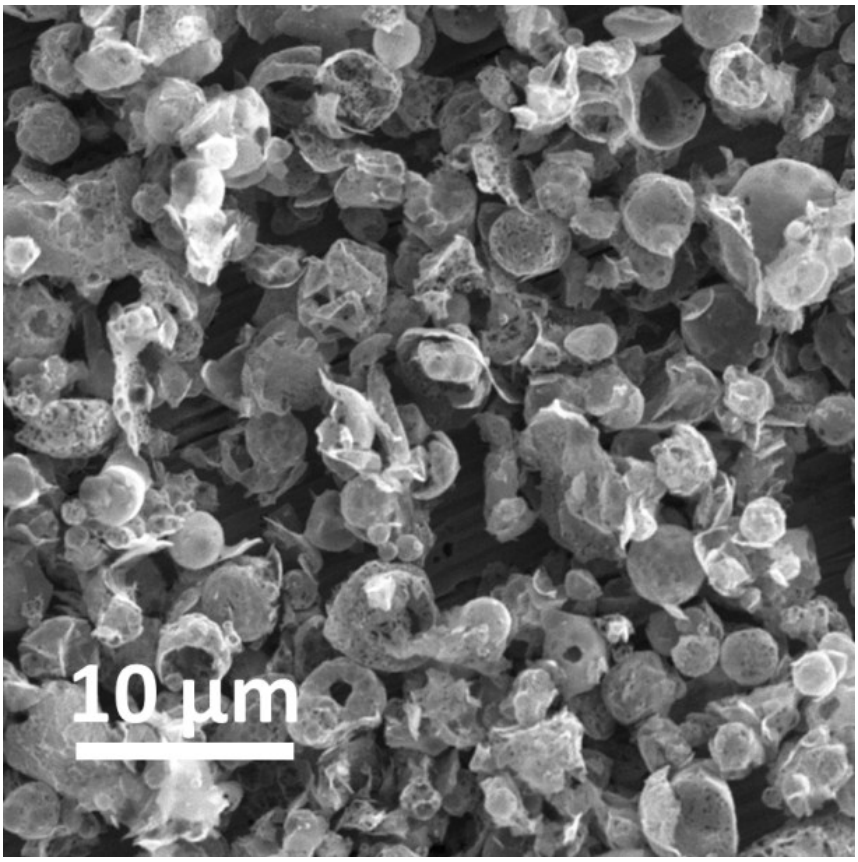


Fig. S4 SEM image of calcined TiO_2-rGO (10%).

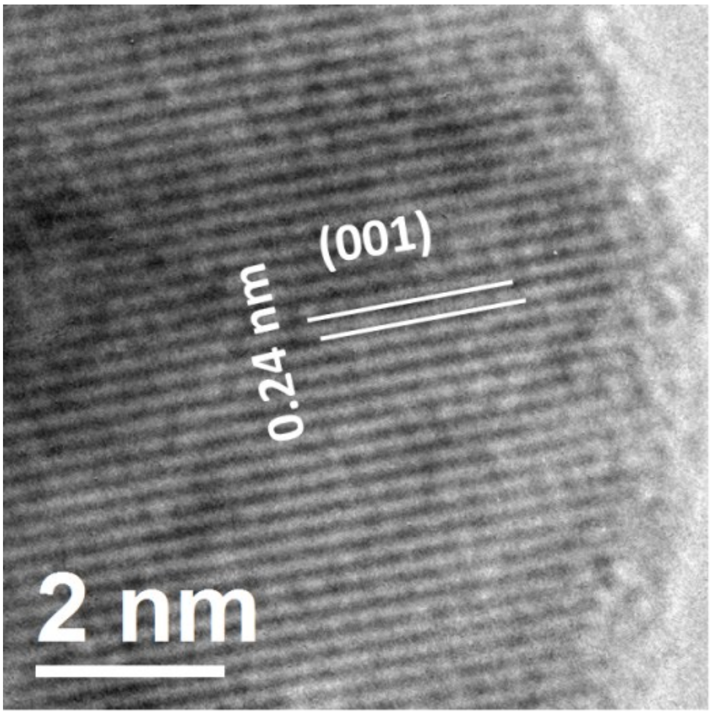


Fig. S5 HR-TEM image of calcined TiO_2-pristine.

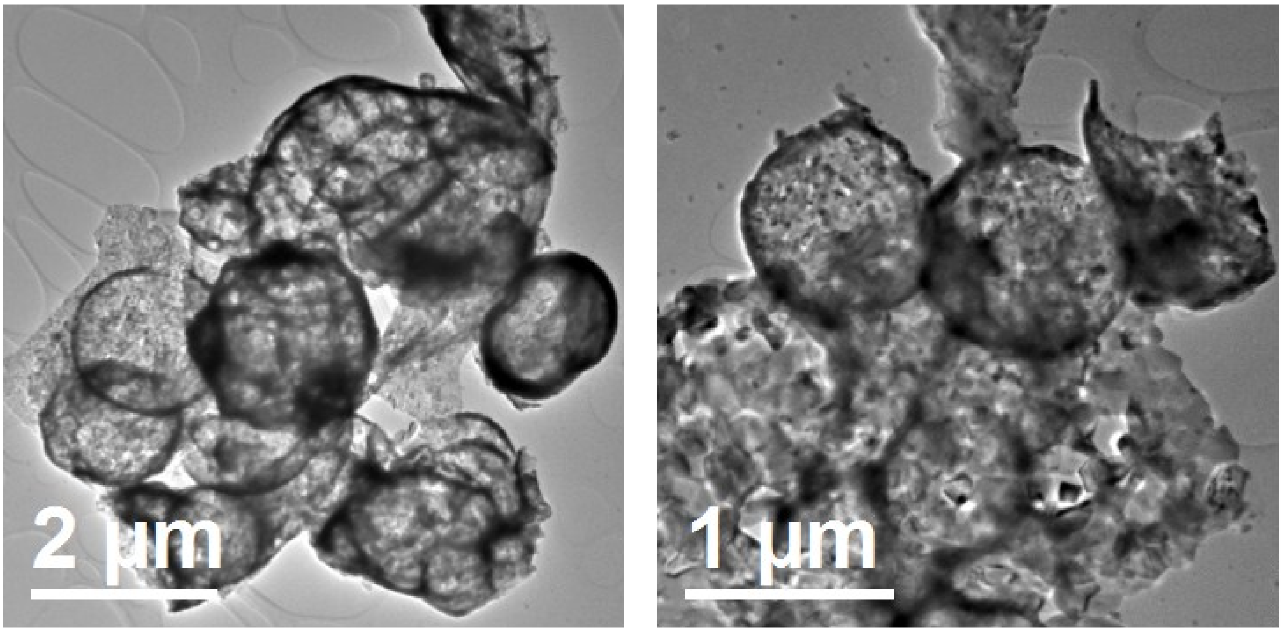


Fig. S6 TEM image of calcined TiO_2-rGO (10%).

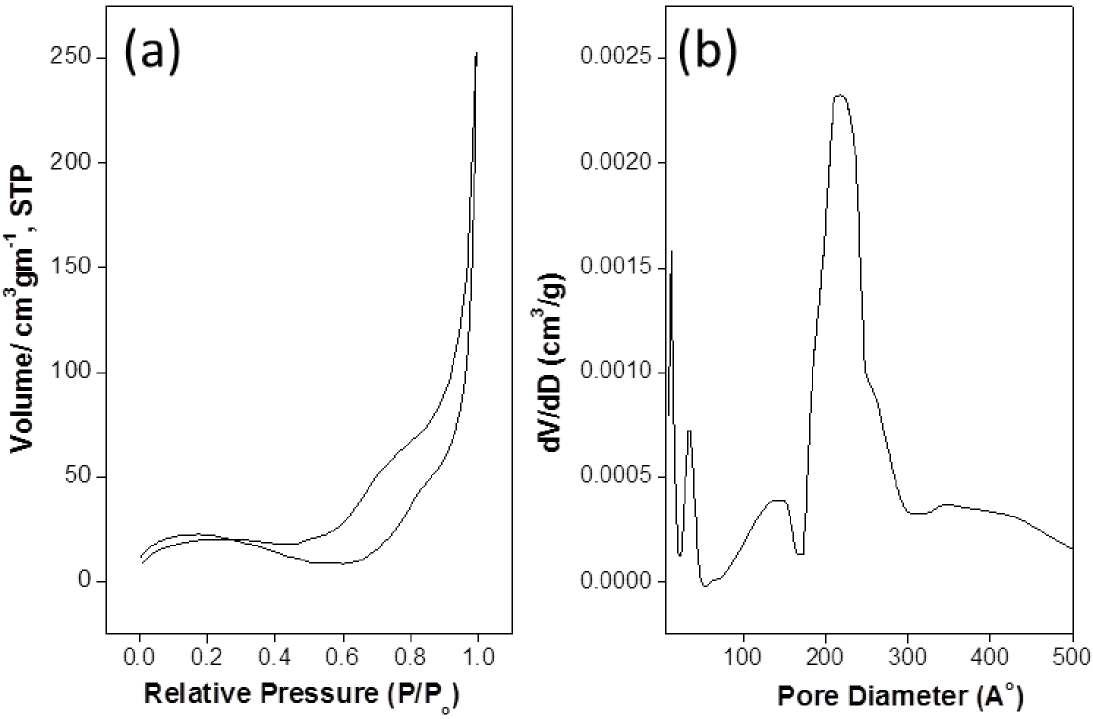


Fig. S7 N_2 sorption isotherm (a) and corresponding pore size distribution (b) curves of the calcined TiO_2-pristine sample.

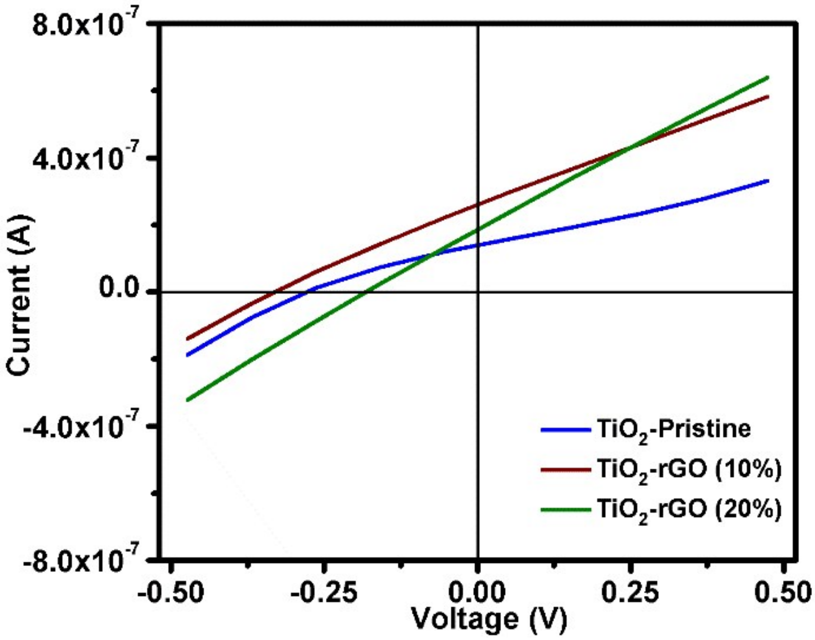


Fig. S8 Current vs voltage (I-V) plots for TiO_2-Pristine, TiO_2-rGO (10%) and TiO_2-rGO (20%).

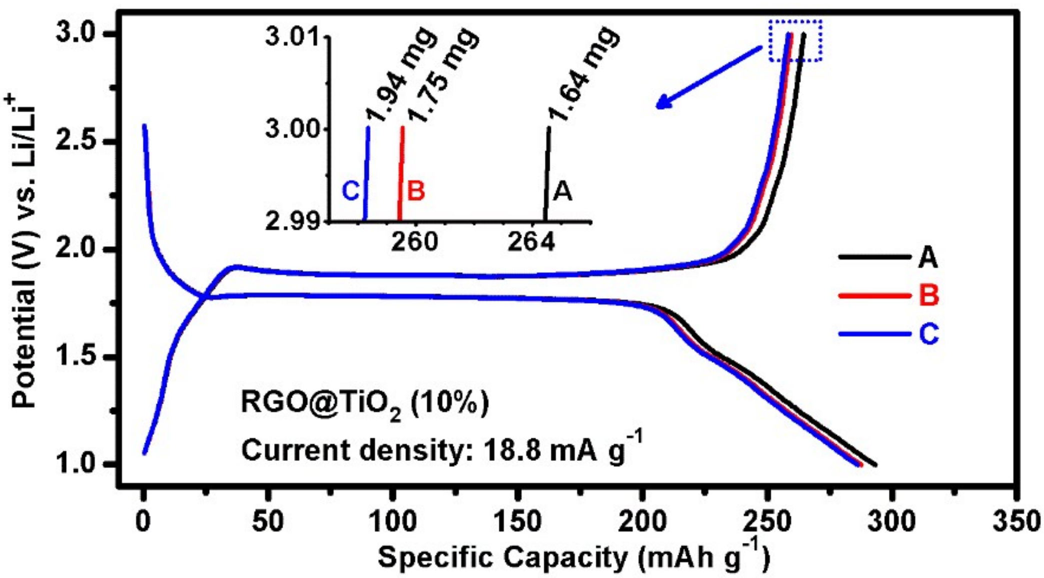


Fig. S9 Variation of specific capacity with mass loading in the electrodes for RGO@TiO_2 (10%)

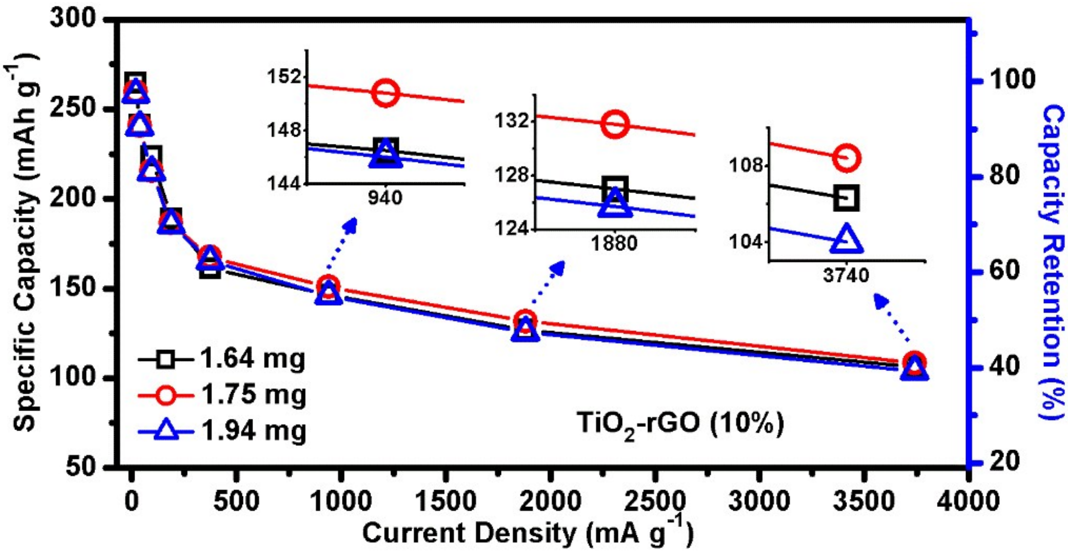
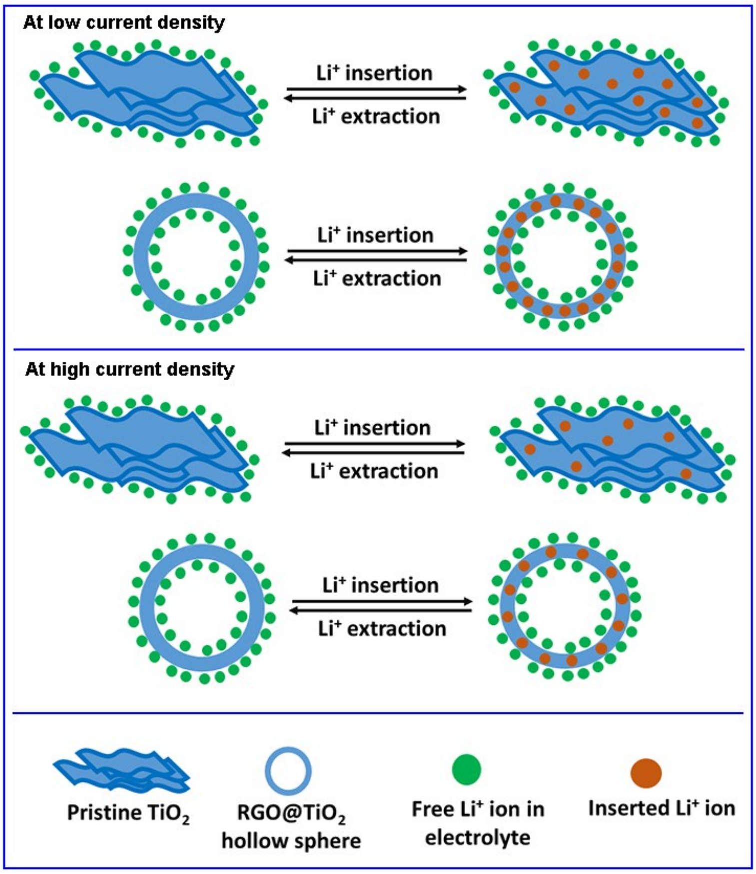


Fig. S10 Specific charge capacity vs. current density plots for TiO_2-RGO (10%) electrodes with different mass loading



Scheme S1 Schematic representation of probable Li^+ storage mechanism.

Supporting Tables

Table S1. A comparison of electrochemical results on TiO_2/carbon hollow spheres.

Materials	Methods of Syntheis	Voltage (V vs. Li/Li^+)	Current Density (mA g^{-1})	Specific Capacity (mAh g^{-1})	Cycling Performances	Ref.
TiO_2 hollow spheres	Sol-gel method, carbon sphere used as template	1.0-2.5	60	139	40	S[1]
TiO_2 hollow spheres	Templated method using polystyrene spheres.	1.0-3.0	35.5	230	50	S[2]
TiO_2 hollow spheres	Hydrothermal followed by calcination.	1.0-2.75	168	~56	50	S[3]
TiO_2 hollow spheres	Solvothermal method.	1.0-3.0	33.6 672	~170 ~80	--	S[4]
Core-shell TiO_2 microsphere	Solvothermal followed by calcination.	1.3-2.5	175	154	80	S[5]
TiO_2 hollow spheres	Solvothermal method.	1.0-3.0	85	131	30	S[6]
Multishelled TiO_2 hollow microspheres	Emulsion polymerization reaction under hydrothermal conditions.	1.0-3.0	168 1675	237 119	100 1200	S[7]
TiO_2 hierarchically porous hollow spheres	Hydrothermal method staring with TiO_2 solid spheres.	1.0-3.0	168	151	200	S[8]
TiO_2/C hierarchically porous hollow spheres	Hydrothermal method starting with TiO_2 solid spheres.	1.0-3.0	168	175	200	S[9]
Nest-like TiO_2 hollow microspheres	Hydrothermal method staring with TiO_2 hollow microspheres.	1.0-3.0	2010	152	100	S[10]
TiO_2 hollow nanospheres	Template method using quasi-nano-sized carbonaceous sphere followed by calcination.	1.0-3.0	167.5 3350	212 103	100 3000	S[11]
TiO_2–Carbon hollow microspheres	Solvothermal followed by calcination.	1.0-2.5	168 3360	204 105	-- --	S[12]
F-doped carbon coated mesoporous TiO_2 hollow spheres	Hydrolysis over polystyrene nano sphere followed by hydrothermal.	1.0-3.0	84 1680	210 98	100 1800	S[13]
Hollow TiO_2/graphitic carbon spheres	Reflux over SiO_2 templet followed by calcination.	1.2-2.5	100 1000	178 137	100 1000	S[14]
TiO_2-rGO (10%) hollow sphere	**Spray drying followed by calcination.**	**1.0-3.0**	**18.8 94 188 374 940 3740**	**265 216 175 166 131 109**	**-- -- 200 -- 800 --**	**This Work**

Table S2. A comparison of electrochemical results on TiO_2/carbon in different morphological shapes.

Materials	Voltage (V vs. Li/Li^+)	Current Density (mA g^{-1})	Specific Capacity (mAh g^{-1})	Cycling Performances	Ref.
TiO_2-graphene nanofibers	1.0-3.0	150	131	300	S[15]
Reduced graphene oxide-supported TiO_2 fiber bundles	0.1-3.0	200 1000	235 150	1000	S[16]
High performance N-doped mesoporous carbon decorated TiO_2 nanofibers	1.0-3.0	33	264	100	S[17]
Mesoporous TiO_2 micro-fibers@nitrogen doped carbon composites	1.0-3.0	850	150	100	S[18]
Sandwich like graphene-TiO_2 nanosheets	1.0-3.0	167.5	180	30	S[19]
Mesoporous anatase TiO_2 nanospheres/graphene composites	1.0-3.0	168	199	100	S[20]
Porous TiO_2/C nanocomposite shells	1.0-3.0	335	171	330	S[21]
TiO_2/graphene nanostructured composite	1.0-3.0	167.5	180	100	S[22]
Carbon–TiO_2 composite (TC400)	0.9-3.0	75	153	30	S[23]
Porous TiO_2 microsphere/RGO composite	1.0-3.0	168	180	100	S[24]
TiO_2 and reduced graphene oxide nanocomposite	0.01-3.0	100	200	100	S[25]
TiO_2–CNT sponges	0.0-3.0	100	210	100	S[26]
Mesoporous TiO_2 nanocrystals grown in situ on graphene aerogels	1.0-3.0	100	200	50	S[27]
Mesoporous TiO_2/graphene/mesoporous TiO_2 sandwich-like nanosheets	1.0-3.0	20	237	100	S[28]
Ultrafine TiO_2 nanoparticles embedded in N-doped graphene networks (UTO/NGF)	1.0-3.0	168 840	165 143	200	S[29]
Carbon-coated mesoporous TiO_2 nanocrystals grown on graphene	1.0-3.0	200	110	100	S[30]
TiO_2/GO nanocomposite (SP20)	1.0-3.0	336	150	50	S[31]
Ultra-small TiO_2 nanoparticles in situ growth on graphene hybrid	0.0-3.0	100	186.6	100	S[32]
Randomly oriented carbon-supported ultra-thin anatase TiO_2	1.0-3.0	170	172	100	S[32]

Table S3. Fitted impedance parameters for TiO_2-Pristine, TiO_2-rGO (10%) and TiO_2-rGO (20%).

State of charge (V)	R_s (Ohm)	R_{ct} (Ohm)
TiO_2-Pristine		
As assembled state	2.1	158
After 1st cycle	3.0	502
After 200th cycle	139	341
TiO_2-rGO (10%)		
As assembled state	2.0	144
After 1st cycle	2.2	462
After 200th cycle	76.5	341
TiO_2-rGO (20%)		
As assembled state	1.9	163
After 1st cycle	2.1	279
After 200th cycle	31.3	148

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