Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Controlled Synthesis of Mesoporous Nanostructured Anatase TiO2 on Genetically Modified Escherichia coli Surface for High Reversible Capacity and Long-life Lithium-ion Batteries

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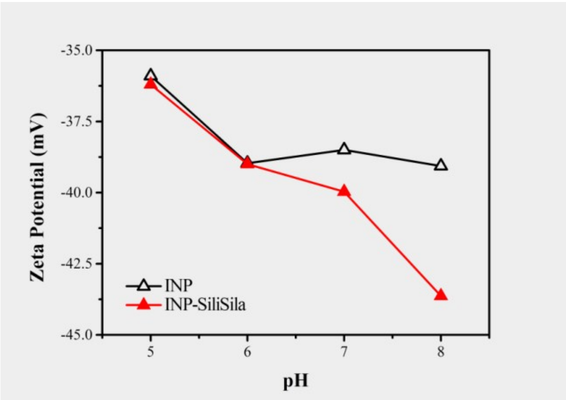

Fig. S1 Zeta potential of E. coli cells with INP or INP-SiliSila displaying on surface.

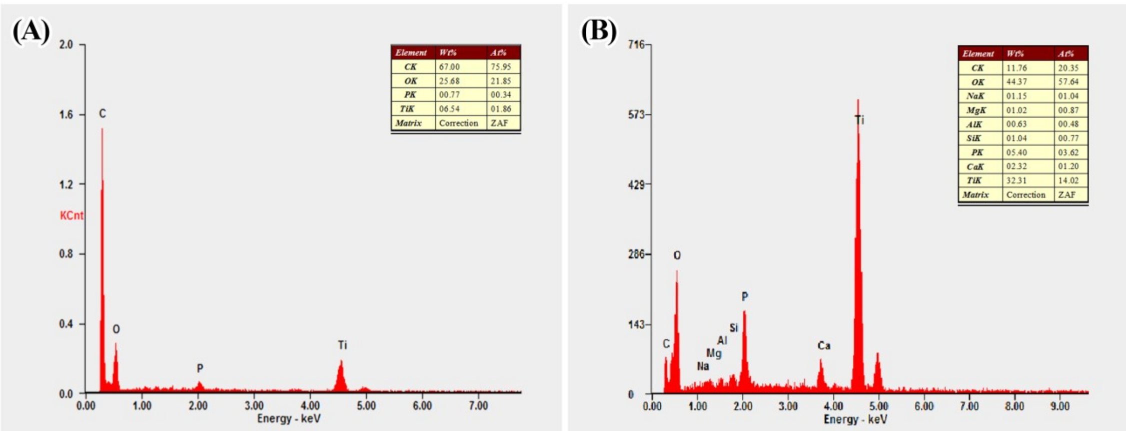

Fig. S2 The EDS spectrum shows TiO_2 deposition on bacterial surface before (Panel A) and after (Panel B) calcination.

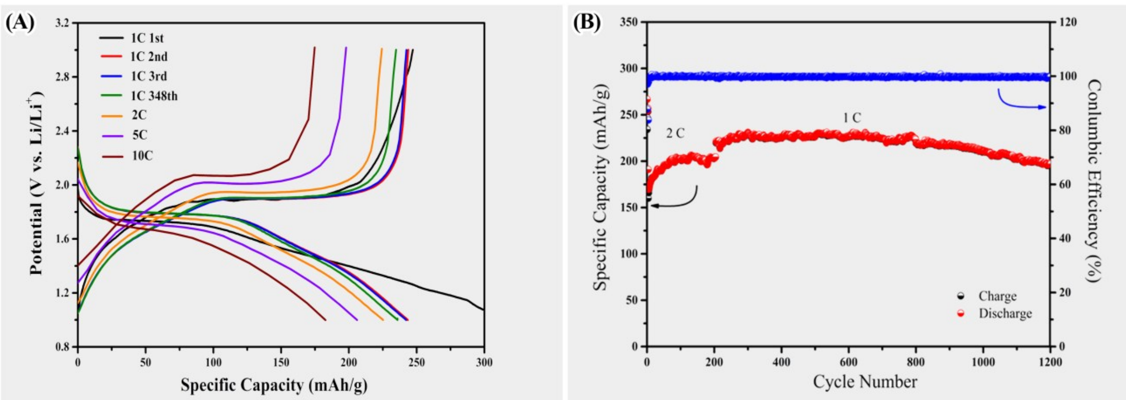

Fig. S3 Electrochemical performance of nanostructured anatase TiO_2 electrode. (A) Charge-discharge voltage profile at various current rate. (B) Ultralong-life cycling performance at a high current rate of 2C and 1C.

Table S1: The relevant discharge capacities, charge capacities and irreversible capacity losses (ICL) at different current rate.

Current rate	1C	1C	1C	1C	2C	5C	10C
Cycle	1st	2nd	3rd	348th	1st	1st	1st
Discharge capacity	317	243.8	242.4	235.9	225.2	206.1	182.7
Charge capacity	247.2	243.8	242.2	234.8	224.3	198	174.8
Irreversible capacity loss	22%	0.1%	0.08%	0.05%	0.04%	4%	4%

Table S2: A comparison of the electrochemical performance between the as-prepared mesoporous nanostructured anatase TiO_2 and reported pure nanostructured TiO_2.

Electrode Materials	Specific Capacity (mAh/g)	Discharge Rate (1C=167mAh/g)	Capacity Retention	References
Mesoporous Nanostructured Anatase TiO_2	243 at 1C retain 97.1% (after 350 cycles) 200 at 2C retain 89% (after 200 cycles) 175 at 10C			This work
Mesoporous hollow TiO_2 microspheres	347	0.5C	66.3% (after 100 cycles)	*J Power Sources* **2011,** *196*, 8618.
Mesoporous TiO_2 fiber	190	0.5C	91.6% (after 100 cycles)	*Electrochim Acta* **2015,** *180*, 658.
TiO_2 hollow nano-Spheres	295.2	1C	71.8% (after 100 cycles)	*Chemical Science* **2016,** *7*, 793.
NYTiO_2 porous microspheres	237	1C	94.9% (after 100 cycles)	*Nanoscale* **2015,** *7*, 12979.
3D interconnected macroporous TiO_2	209	1C	88.8% (after 200 cycles)	*Rsc Advances* **2016,** *6*, 26856.
Nanoporous Anatase TiO_2 Mesocrystals	204.7	1C	74.2% (after 60 cycles)	*J. Am. Chem. Soc.* **2011,** *133*, 933.
Mesoporous TiO_2 microspheres	191	1C	84% (after 100 cycles)	*Nanoscale* **2014,** *6*, 14926.
Hierarchical mesoporous TiO_2 nanowire bundles	189	1C	74.6% (after 100 cycles)	*Advanced Science* **2015,** *2* (7).
Submicron-sized mesoporous anatase TiO_2 beads	172	1C	85.1% (after 200 cycles)	*Rsc Advances* **2013,** *3*, 13149.
Mesoporous TiO_2-B/anatase microparticles	247	1C (1C=330 mAh/g)	69.2% (after 80 cycles)	*Chinese Journal of Chemical Engineering* **2015,** *23*, 583.
Hierarchical 3D ordered macro-mesoporous TiO_2	223	4C	83.4% (after 50 cycles)	*J Mater Chem A* **2014,** *2*, 9699.
Hierarchically porous hollow TiO_2 microspheres	158	5C	82.9% (after 100 cycles)	*Chemical Engineering Journal* **2013,** *228*, 724.
Mesoporous single-grain layer anatase nanosheets	120	5C (1C=170 mAh/g)	60.8% (after 4000 cycles)	*J Mater Chem A* **2015,** *3*, 6455.
Mesoporous TiO_2-B nanowires	248	6C	79% (after 50 cycles)	*J Mater Sci* **2015,** *50*, 6321.
Crystalline TiO_2 hollow spheres	184.1	10C (1C=173 mAh/g)	69.2% (after 1000 cycles)	*Science advances* **2016,** *2*, e1501554.
Mesoporous anatase TiO_2	126	10C	98.5% (after 1100 cycles)	*J Alloy Compd* **2016,** *674*, 174.
Mesoporous titania rods	262	0.1 A/g	81% (after 40 cycles)	*J Power Sources* **2012,** *214*, 298.
Mesoporous Titania Nanotubes	~210	10 A/g	57% (after 30 cycles)	*Advanced Materials* **2007,** *19*, 3016.

Note: The discharge-charge capacities of some TiO_2 materials have reached 395.2 at 1C current rate. Most of these TiO_2 materials reach the theoretical discharge-charge capacity of 167. The as-prepared TiO_2 material in the present study exhibit a discharge-charge capacity of 243 that is higher than most reported ones. Besides, the as-prepared TiO_2 materials show higher stability. It retains 97% of the discharge-charge capacity after 350 cycles at 10C current rate.

Table S3: A comparison of the electrochemical performance between the as-prepared mesoporous nanostructured anatase TiO_2 and doped or composite TiO_2.

Electrode Materials	Specific Capacity (mAh/g)	Discharge Rate (1C=167mAh/g)	Capacity Retention	References
Mesoporous Nanostructured Anatase TiO_2	243 at 1C retain 97.1% (after 350 cycles) 200 at 2C retain 89% (after 200 cycles) 175 at 10C			This work
Mesoporous MoS_2-TiO_2 Nanofibers	165	6C	75.2% (after 1000 cycles)	*Chemelectrochem* **2015,** *2*, 374.
Cr_2O_3@TiO_2 yolk/shell octahedrons	~700	0.5C	72.8% (after 500 cycles)	*Micropor Mesopor Mat* **2015,** *203*, 86.
C-SnO_x@TiO_2	~480	2000 mA/g	78.5% (after 1000 cycles)	*Mater Lett*

				2015, *155*, 142.
mesoporous $TiO_2/SnO_2/C$ hollow microspheres	~390	2000 mA/g	83% (after 500 cycles)	*J Power Sources* **2015,** *279*, 528.
Ag/TiO_2 core-shell nanocables	181	1C	88.4% (after 230 cycles)	*New J Chem* **2015,** *39*, 7889.
TiO_2/MWCNT composites	316	0.2C	96.9% (after 100 cycles)	*Acs Applied Materials & Interfaces* **2015,** *7*, 3676.
Hierarchal mesoporous SnO_2@C@TiO_2 nanochains	807	100 mA/g	45.7% (after 100 cycles)	*Electrochim Acta* **2015,** *184*, 219.
Submicron-sized mesoporous anatase TiO_2@SnO_2	731.5	1C	59.7% (after 850 cycles)	*J Alloy Compd* **2015,** *639*, 60.
H-TiO_2/GC hollow spheres	~150	5C (1 A/g)	91.3% (after 1000 cycles)	*J. Am. Chem. Soc.* **2015,** *137*, 13161.
mTiO_2/Graphene/ mTiO_2 Sandwich-Like Nanosheets	247	0.1C (20 mA/g)	95.9% (after 100 cycles)	*Nano Letters* **2015,** *15*, 2186.
mesoporous hollow C/F/TiO_2	252	0.5C	83.3% (after 100 cycles)	*Electrochim Acta* **2015,** *157*, 1.
mesoporous TiO_2 fibers@N-doped@carbon composite	125.1	10C	85.2% (after 500 cycles)	*Nanoscale* **2015,** *7*, 13898.
Mesoporous TiO_2-Carbon	171	1C	76.6% (after 100 cycles)	*J Electrochem Soc* **2015,** *162*, D3013.
carbon coated TiO_2 nanoparticles	~410	30 mA/g	65.9% (after 300 cycles)	*J Alloy Compd* **2014,** *606*, 61.
Carbon nanofiber-templated mesoporous TiO_2 nanotubs	108.1	2C	100% (after 500 cycles)	*Rsc Advances* **2014,** *4*, 9061.
Mesoporous 3D TiO_2/CNTs	79	89C (15 A/g)	90% (after 900 cycles)	*J Power Sources* **2014,** *254*, 18.
hierarchical mesoporous TiO_2-C sub-microspheres	212	1C	71.2% (after 50 cycles)	*Rsc Advances* **2014,** *4*, 19266.
mesoporous TiO_2/graphene nanocomposite	~160	5000 mA/g	88.6% (after 100 cycles)	*Chem. Eng. J.* **2014,** *256*, 247.
CNTs/mTiO_2 coaxial nanocables	~190	1C	96.3% (after 70 cycles)	*Carbon* **2014,** *75*, 345.
C-coated TiO_2 mesoporous microspheres	~180	1C	87.4% (after 200 cycles)	*Electrochim Acta* **2014,** *120*, 231.
Cr, N-codoped mesoporous TiO2 microspheres	159.6	5C	99% (after 300 cycles)	*J Mater Chem A* **2014,** *2*, 1818.
Sandwich-like m-anatase TiO_2 Sheets/rGO	230	1C	70% (after 50 cycles)	*Rsc Advances* **2014,** *4*, 43039.
Ordered mesoporous TiO_2-C nanocomposite	174	1C	95.4% (after 900 cycles)	*J Mater Chem A* **2013,** *1*, 4293.
Mesoporous anatase TiO_2/3D GN	314	0.5C	62.7% (after 100 cycles)	*J Mater Chem A* **2013,** *1*, 12750.
mesoporous 6% Sn-doped TiO_2 thin film	575.7	0.5C	43.9% (after 80 cycles)	*J Mater Chem A* **2013,** *1*, 13222.
C&N co-doped mesoporous TiO_2	~200	1C	80% (after 100 cycles)	*Rsc Advances* **2013,** *3*, 3836.
Mesoporous TiO_2/multilevel carbon networks	152.1	5C	92% (after 3000 cycles)	*Rsc Advances* **2013,** *3*, 24882.
Mesoporous TiO_2-Sn@C core-shell microspheres	~550	500 mA/g	37.5% (after 2000 cycles)	*Chem Commun* **2013,** *49*, 2792.
3D Mesoporous, micro/nanosized TiO_2/C Nanocomposites	135.4	0.5 A/g	98.9% (after 100 cycles)	*Acs Applied Materials & Interfaces* **2012,** *4*, 2985.
Ordered mesoporous carbon-TiO_2	618	0.1C	81% (after 80 cycles)	*Carbon* **2012**, *50*, 4259.
TiO_2@reduced graphene oxide nanocomposite	386.4	5C (1000 mA/g)	39.5% (after 100 cycles)	*J Mater Chem* **2012**, *22*, 9759.
Zn doped mesoporous TiO_2	~160	1C	87% (after 100 cycles)	*J Mater Chem* **2012**, *22*, 17625.
Sandwich-Like G-TiO_2 Nanosheets	269	0.2C	67% (after 30 cycles)	*Advanced Materials* **2011**, *23*, 3575.

Note: Comparing with doped or composite TiO_2, the as-prepared TiO_2 in the present study exhibited higher than average electrochemical performance.