Supporting Information

for

Free-Standing TiO_2 Nanograssy Tubular Hybrid Membrane for Polysulfide Trapping in Li-S Battery

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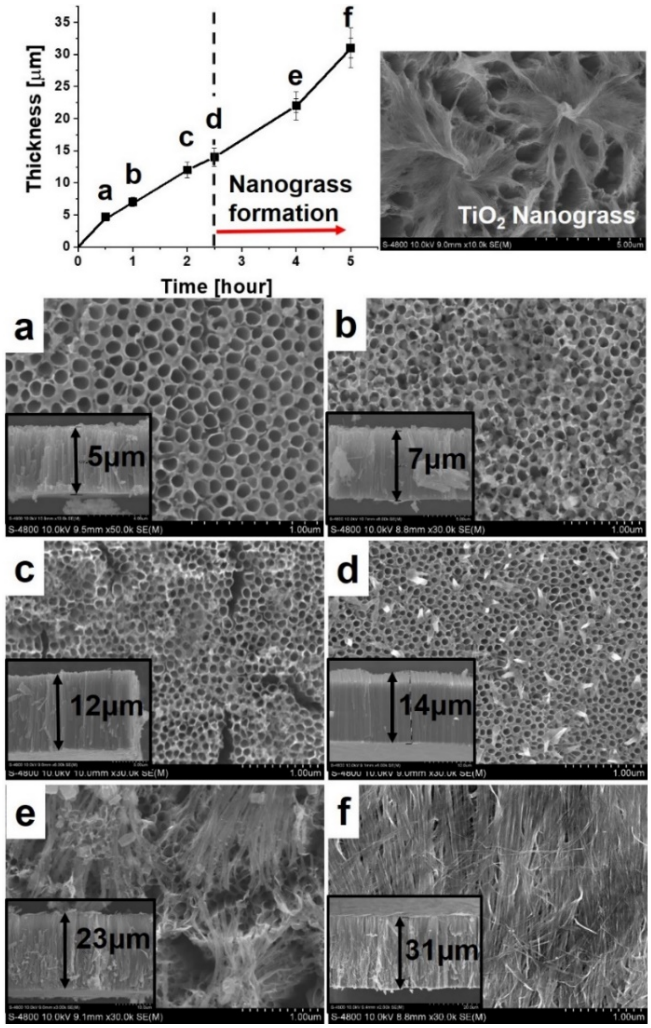

Figure S1. SEM image of TiO_2 nanotube arrays at various anodization time. (a) 30 minutes, (b) 1 hour, (c) 2 hours, (d) 2.5 hours, (e) 4 hours, and (f) 5 hours, respectively. The insets show the layer thickness. After 2.5 hours anodization (d), the needle like TiO_2 nano grasses begin to form on the surface of TNT layers.

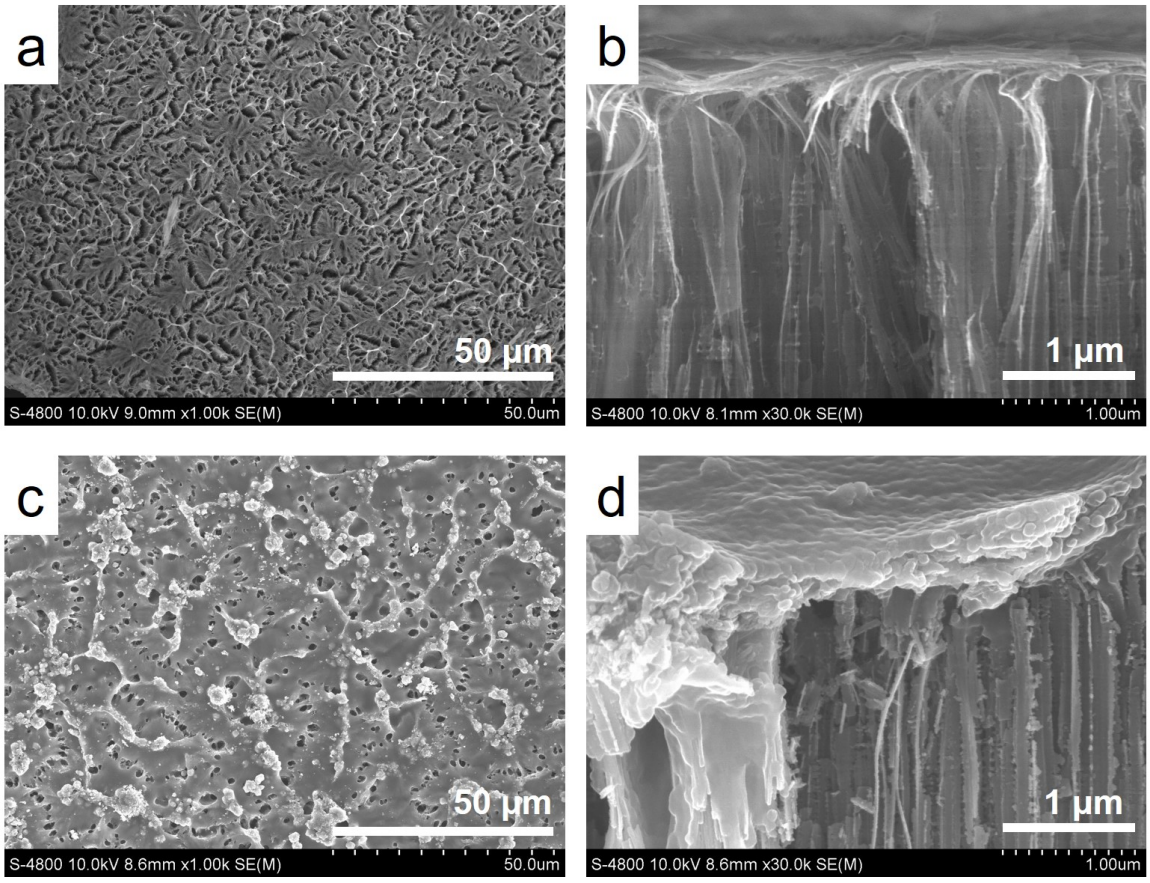

Figure S2. SEM image of nanograss surface and cross-sectional view of before (a, b) and after (c, d) polymer coating. After the rubber type polymer coating, the layer maintain the open pore structures.

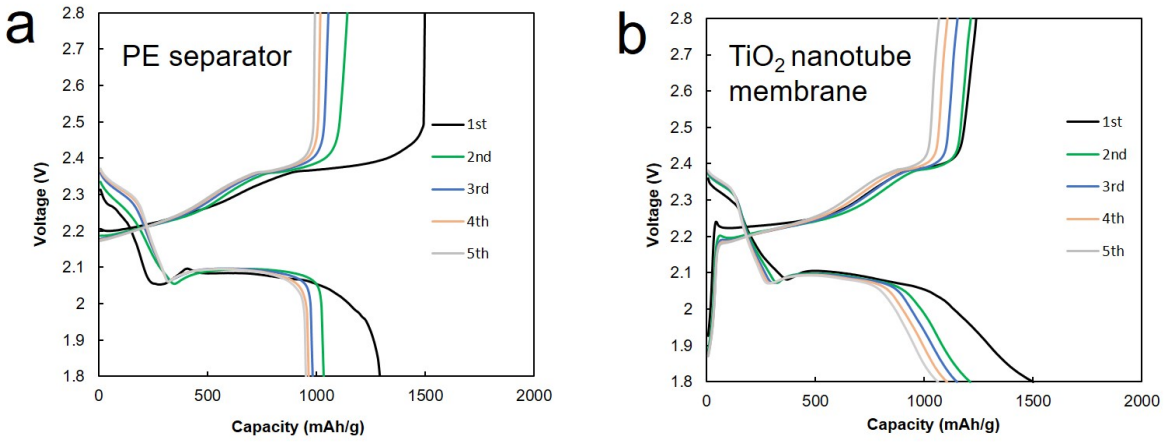

Figure S3. Initial charge-discharge profile of (a) polyethylene (PE) and (b) TiO_2 nanotube (TNT) Membrane.

Table S1. Summary of the various type TiO_2 membrane in Li-S battery: initial discharge capacity at the C-rate and final discharge capacity (cycle) vs. TiO_2 nanograssy Membrane. [From Ref. SR 1-12]

Ref.	Characteristics	Initialdischarge capacity@ C-rate [mAh g^{-1}]	Final discharge capacity (cycle) [mAh g^{-1}]
[1]	Hydrothermally obtained TiO_2 nanotubes/rGO	1200 @ 0.2 C	510 (200)
[2]	TiO_2 nanosheets/N doped carbon	1201 @ 1.0C	600(900)
[3]	TiO_2 [a)]/N-doped carbon hollow spheres	1200 @ 1.0C	780(100)
[4]	Mesoporous carbon/TiO_2 [a)]	1050 @ 2.0C	700(500)
[5]	TiO_2[a)]/Porous carbon nanotubes	1100 @ 0.5C	850(200)
[6]	Nano TiO_2[a)]/Carbon	1200 @ 0.1C	840(180)
[7]	TiO_2 [a)]/Porous Carbon composite	1100 @ 0.1C	700(150)
[8]	Multi-functional TiO_2 nanosheets/CNT	1200 @ 0.2C	500(200)
[9]	RGO/Brookite TiO_2 [a)]	1100 @ 0.2C	420(100)
[10]	TiS_2-TiO_2 [a)]/Mxene	900 @ 0.2C	700(100)
[11]	TiO_2 [a]/rGO	1100 @ 0.2C	750(100)
[12]	TiO_2 quantum dots/MWCNT	1200 @ 0.2C	620(600)
This work	**TiO_2 nanotube membrane**	**1499 @ 0.1C**	**618(100)**

[a)] (Nanoparticle)

Supplemental references

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