Supplementary Information for:

Si Nanotubes ALD Coated with TiO₂, TiN or Al₂O₃ as High Performance Lithium Ion Battery Anodes

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Figure S1: SEM micrographs of (a) SiNTs, (b) SiNTs/TiO₂, (c) SiNTs/Al₂O₃, (d) SiNTs/TiN electrodes. (e) FIB cross-section of SiNTs/TiO₂ showing the height of the nanotubes as approximately 3 μ m.



Figure S2: TEM micrograph of the as synthesized materials, showing a bright field micrograph with the corresponding indexed SAD pattern, and a dark field micrograph of the polycrystalline Si obtained using a portion of 111_{Si} ring pattern. (a) and (b) TiO₂/SiNTs/TiO₂; (c) and (d) TiO₂/SiNTs



Figure S3: XPS spectra of the TiO₂-coated SiNTs electrodes in as-synthesized state.



Figure S4: Constant current voltage profiles and differential capacity curves, tested at 0.2 C, at 1, 2, 20, 50 and 100 cycles. (a) and (b) SiNTs/TiO₂, (c) and (d) TiO₂/SiNTs. (e) Magnification of the first 50 mAh/g for TiO₂/SiNTs in the first discharging cycle at 0.2 C rate. (f) Magnification of the dC/dV for the TiO₂/SiNTs in the first discharging cycle at 0.2 C. They highlight the plateau and the related peak in the dC/dV profile for TiO₂/SiNTs sample corresponding to the lithiation of anatase TiO₂.



Figure S5: (a) and (d) $AI_2O_3/SiNTs$, b) and (e) $SiNTs/AI_2O_3$, (c) and (f) $/AI_2O_3/SiNTs/AI_2O_3$. (g) Magnification of the first 800 mAh/g in the first discharging cycle at 0.2 C rate.



Figure S6: (a) and (d) TiN/SiNTs, (b) and (e) SiNTs/TiN, (c) and (f) /TiN/SiNTs/TiN. (g) Magnification of the first 800 mAh/g in the first discharging cycle at 0.2 C rate.



Figure S7: (a) and (b) Capacity retention vs. cycle number of Al_2O_3 coated SiNTs, highlighting the role of coating location, i.e. inner surface, outer or both. (c) corresponding coulombic efficiency.



Figure S8: (a) and (b) Capacity retention vs. cycle number of TiN coated SiNTs, highlighting the role of coating location, i.e. inner surface, outer or both. (c) corresponding coulombic efficiency.



Figure S9: Impedance spectra for as-synthesized, (a), after 100 cycles in delithiated state, (b) for bare SiNTs and inner, outer and double-sided TiO_2 -coated SiNTs.



Figure S10: FIB cross-sections (top row) and plane-view SEM images (bottom row) after 100 cycles of bare SiNTs (a and e), $TiO_2/SiNTs$ (b and f), $SiNTs/TiO_2$ (c and g) and $TiO_2/SiNTs/TiO_2$ (d and h) Despite the original structure of the nanotubes still being recognizable for all electrodes, SiNTs and $TiO_2/SiNTs$ clearly show more structural damage compared to and $TiO_2/SiNTs/TiO_2$, in agreement with cycle life and CE data.