Supporting Information

Morphology and Interfacial Design of SnO_2 Thin-Film Anodes for High-Performance Lithium-Ion Batteries

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Parameter	Condition
Target	Sn metallic (99.994-99.999% pure)
Substrate	Stainless steel (~10 nm Ti-coated)
RF Power	60 W (~2.96 W/cm^2)
Sputtering gas	Ar (15 sccm) O_2 (15 sccm)
Thin film thickness	300-500 nm
Sputtering pressure	2×10^{-6} (torr)
Deposition temperature	RT 300°C

Table TS1. RF magnetron sputtering conditions of SnO_2 thin films

Table TS2. Synthesis details of sputtered and annealed SnO_2 electrodes

Sample name	Abbreviation	Annealing temperature	Annealing atmosphere	Deposition temperature
Sputtered SnO_2 electrode at RT	SnO_2-RT	-	-	RT
Sputtered SnO_2 electrode at 300°C	SnO_2-300	-	-	300°C
Sputtered SnO_2 electrode at RT - annealed in air	SnO_2-RT-620	620°C, 2h, 10°C/min	air	RT

Sputtered SnO_2 electrode at 300^{o}C - annealed in air	SnO_2-300-620			300^{o}C

Table TS3. Modification parameters for SnO_2-RT-620 electrodes

Sample name	Abbreviation	Coating	Used Electrolyte
Sputtered SnO_2 electrode at RT (Previously SnO_2-RT-620)	SnO_2-bare	-	1M $LiPF_6$ in (EC:DEC:EMC 1:1:1)
Sputtered SnO_2 electrode at RT + C-coated	SnO_2-C	C	1M $LiPF_6$ in (EC:DEC:EMC 1:1:1)
Sputtered SnO_2 electrode at RT + C-coated with 5 wt. % VC	SnO_2-C-VC	C	1M $LiPF_6$ in (EC:DEC:EMC 1:1:1) + 5 wt. % VC

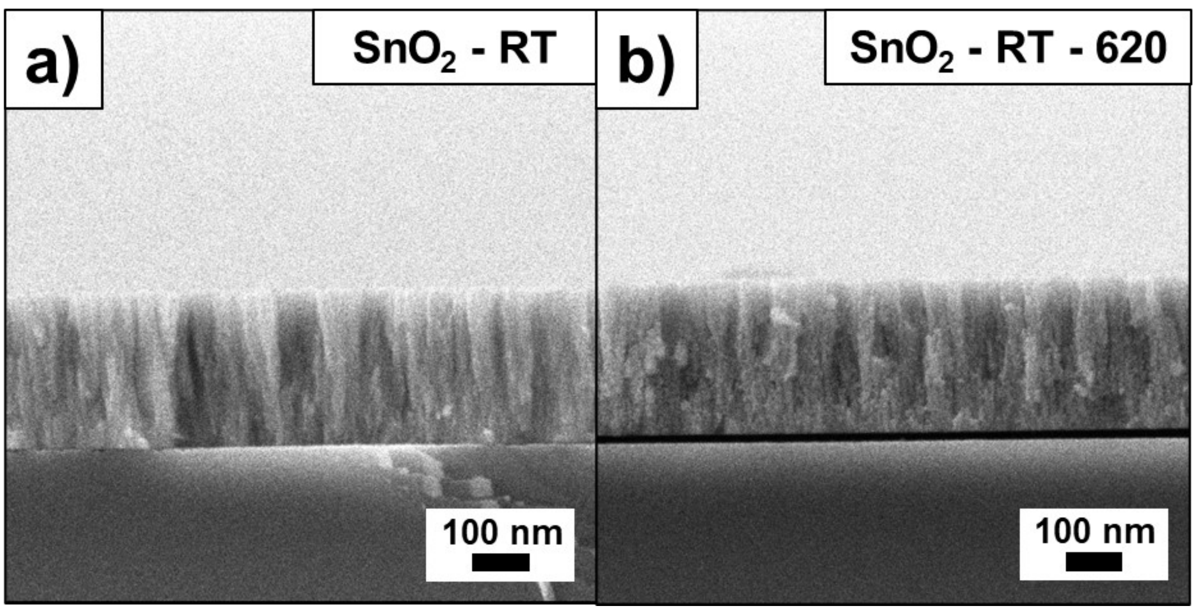

Figure FS1. Cross-sectional SEM images of (a) SnO_2-RT and (b) SnO_2-RT-620 thin film electrodes.

A comparative analysis of the XRD patterns (**Figure FS2**) of the bare SnO_2 and C - coated SnO_2 samples demonstrates a complete coincidence of the main peaks at 2θ = ~26.7°, ~33.9°, ~37.9°, ~51.7° and ~66.2°, characteristic of tetragonal rutile SnO_2 (JCPDS card no. 00-041-1445) [19, 21]. Reflections from SS substrate (JCPDS card no. 01-071-4649) are also present. The absence of extraneous phase lines indicates high phase purity, and the identity of the SnO_2 and SnO_2-C spectra confirms that the carbon coating does not disturb the SnO_2 crystal lattice. At the same time, the XRD analysis of SnO_2-C did not reveal characteristic carbon peaks, which is due to its amorphous or nanocrystalline state.

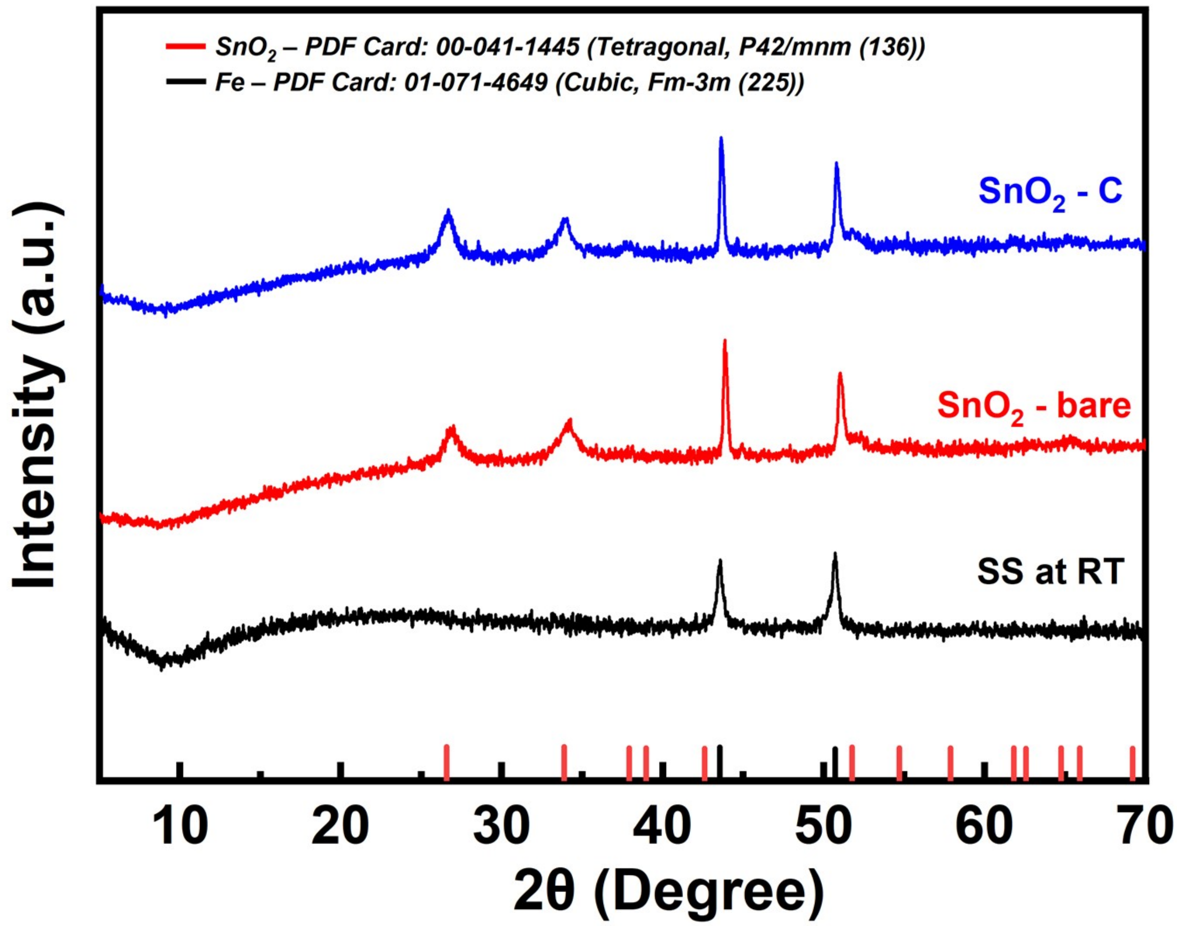

Figure FS2. XRD patterns of SnO_2-bare and SnO_2-C thin films.

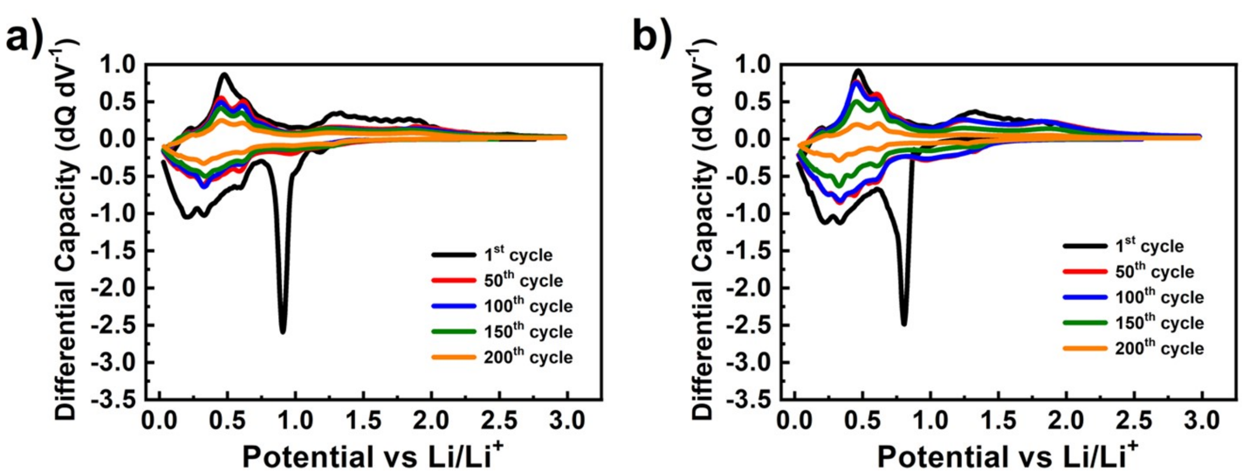

Figure FS3. dQ/dV curves of SnO_2-bare (a) and SnO_2-C (b) thin films.

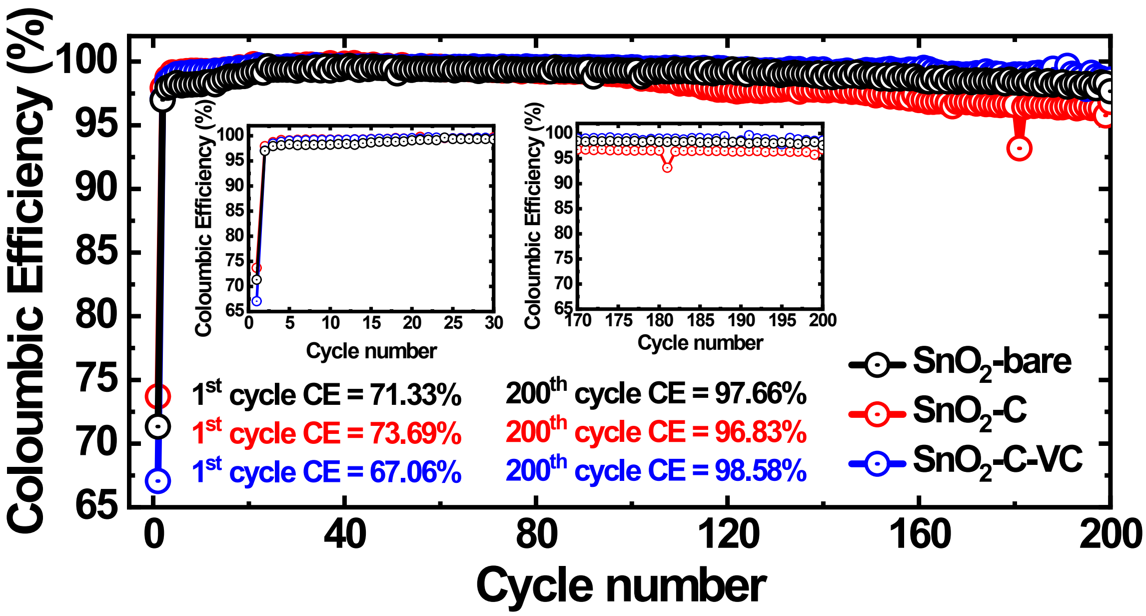

Figure FS4. Coulombic efficiency of SnO_2-bare, SnO_2-C, and SnO_2-C-VC during the initial cycles and after 200 cycles.

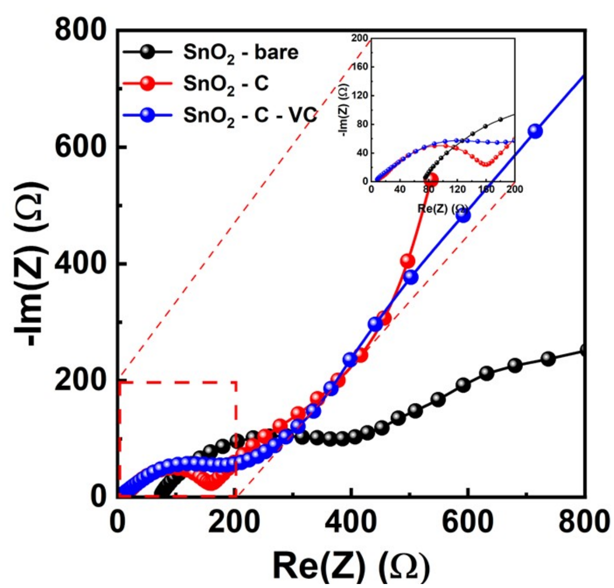

Figure FS5. Nyquist plot of SnO_2-bare, SnO_2-C and SnO_2-C-VC after 200 cycles.