Electronic Supplementary Material (ESI) for Nanoscale Advances.


Electronic Supplementary Information to

# Ordered $SnO_2$ Nanotube Arrays of Tuneable Geometry as a Lithium Ion Battery Material with High Longevity

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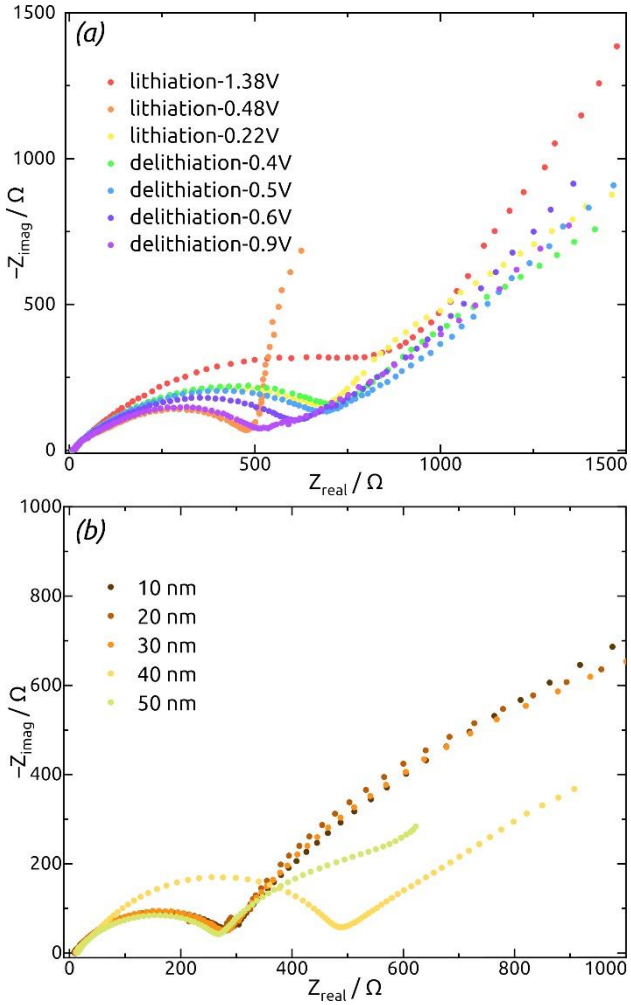


**Figure S1.** Nyquist plots of galvanostatic electrochemical impedance spectroscopy (EIS) measurements recorded of $SnO_2$ nanotube electrodes. Equivalent electrical circuit models shown in Figure 8 are used to fit the spectra of sample. *(a)* EIS measurements were performed on $SnO_2$ nanotube electrode (ℓ = 40 nm, *L* = 30 µm, 4 mm macroscopic sample diameter), which was charged/discharged to a certain voltage before EIS measurements. *(b)* EIS spectra for $SnO_2$ nanotube electrodes with different wall thicknesses in the delithiated state after 10 lithiation/delithiation cycles.

**Table S1.** Summary of EIS parameters fitted for various $SnO_2$-based systems. The first two datasets refer to a sample with 40 nm tube wall thickness at various stages of charge and discharge. The third dataset compares samples with various tube wall thicknesses in the discharged state at 2.80 V.

| | $R_s$ / Ω | $Q_{SEI}$ / µS $s^{0.8}$ | $R_{SEI}$ / Ω | $Q_{dl}$ / µS $s^{0.9}$ | $R_{sf+ct}$ / Ω |
|---|---|---|---|---|---|
| **lithiation** | | | | | |
| 1.38 V | 12.4 ± 0.2 | 42.5 ± 1.2 | 70.5 ± 11 | 5.9 ± 0.3 | 557.9 ± 10 |
| 0.48 V | 9.4 ± 0.3 | 23.9 ± 0.6 | 116.1 ± 13 | 8.1 ± 0.7 | 286.8 ± 12 |
| 0.22 V | 8.8 ± 0.2 | 25.5 ± 0.7 | 213.9 ± 45 | 8.1 ± 1.2 | 411.1 ± 39 |
| **delithiation** | | | | | |
| 0.40 V | 9.4 ± 0.2 | 25.9 ± 0.8 | 237.3 ± 55 | 8.5 ± 1.4 | 426.3 ± 47 |
| 0.50 V | 9.1 ± 0.2 | 25.3 ± 0.7 | 242.2 ± 52 | 9.1 ± 1.4 | 399.4 ± 46 |
| 0.60 V | 10.2 ± 0.2 | 26.2 ± 0.7 | 210.5 ± 44 | 9.1 ± 1.4 | 356.4 ± 39 |
| 0.90 V | 8.7 ± 0.2 | 23.7 ± 0.4 | 170.2 ± 20 | 10.0 ± 1.0 | 317.3 ± 18 |
| **different thicknesses** | | | | | |
| 10 nm | 9.0 ± 0.1 | 3.7 ± 0.09 | 34.0 ± 2 | 2.3 ± 0.07 | 193.9 ± 2 |
| 20 nm | 11.9 ± 0.1 | 8.0 ± 0.30 | 17.8 ± 1 | 3.4 ± 0.09 | 192.9 ± 2 |
| 30 nm | 11.8 ± 0.1 | 3.7 ± 0.10 | 31.6 ± 3 | 1.8 ± 0.07 | 194.7 ± 3 |
| 40 nm | 12.1 ± 0.1 | 2.4 ± 0.05 | 46.5 ± 2 | 1.8 ± 0.04 | 405.4 ± 3 |
| 50 nm | 15.3 ± 0.2 | 3.0 ± 0.06 | 79.2 ± 5 | 3.4 ± 0.2 | 169.7 ± 5 |

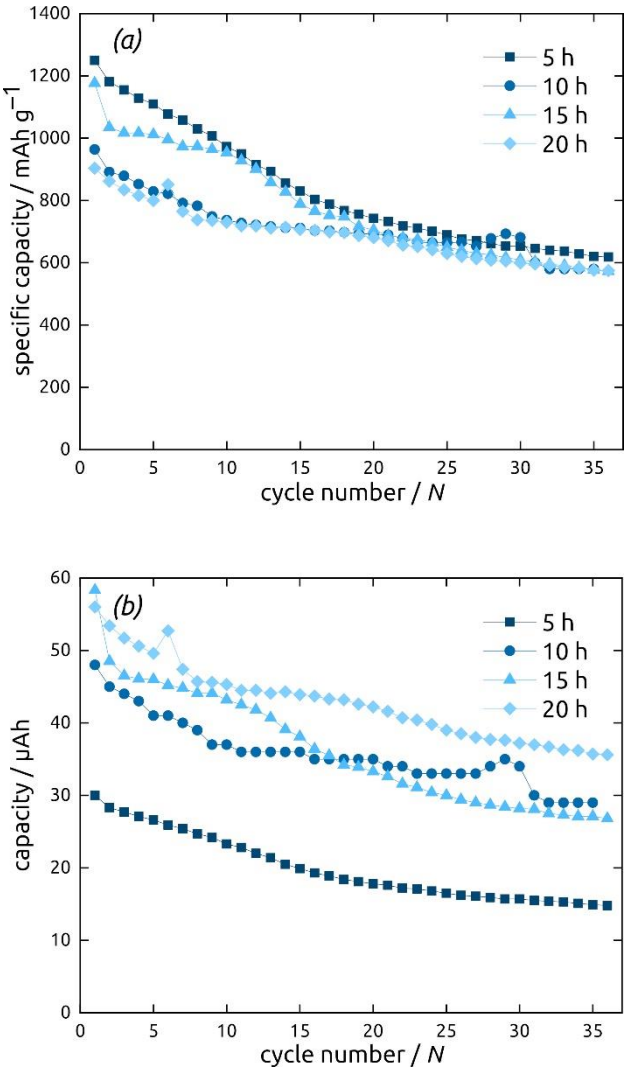


**Figure S2.** Galvanostatic charging and discharging curves of $SnO_2$ nanotube electrodes with 10 nm wall thickness. The length of $SnO_2$ nanotubes has been varied. *(a)* and *(b)* show specific capacity and absolute capacity of $SnO_2$ nanotubes with different lengths, respectively.