

Supplemental Information for

Electrochemical performances and gassing behavior of high surface area titanium niobium oxides

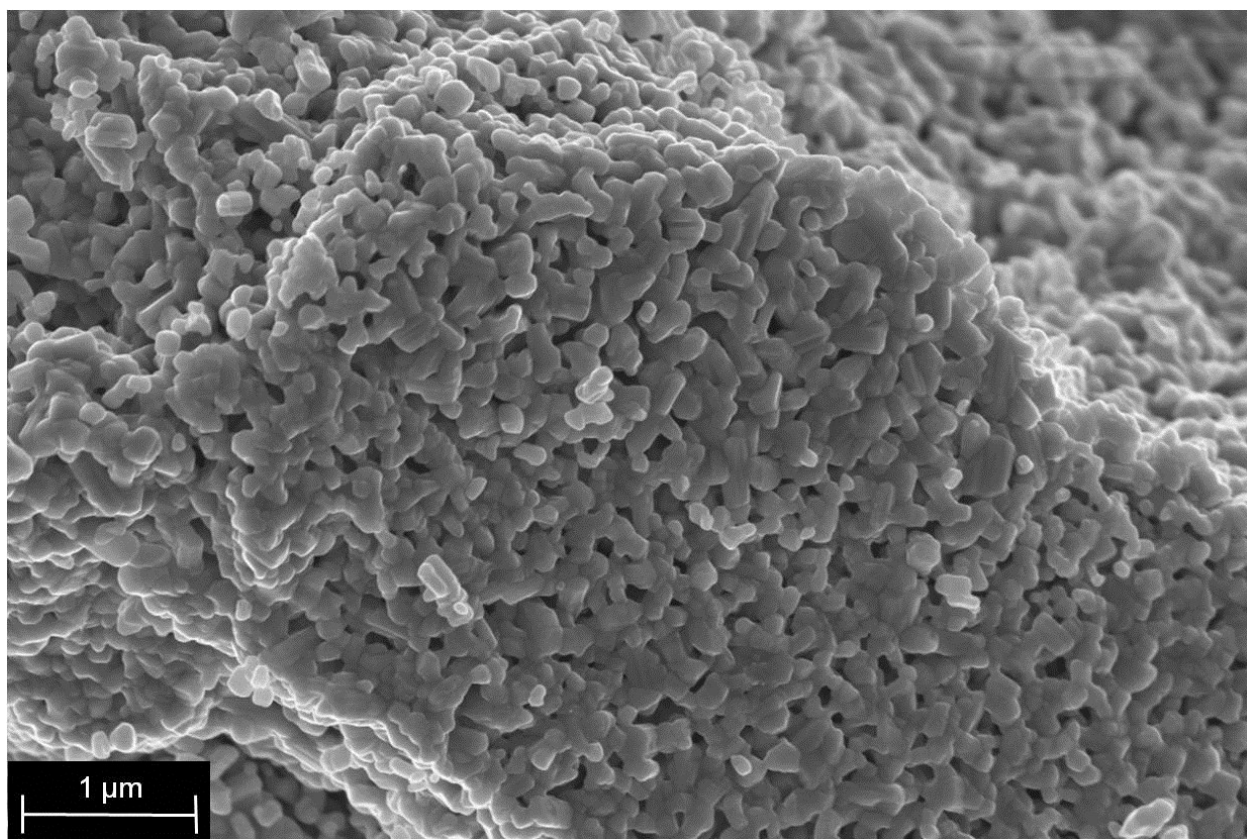
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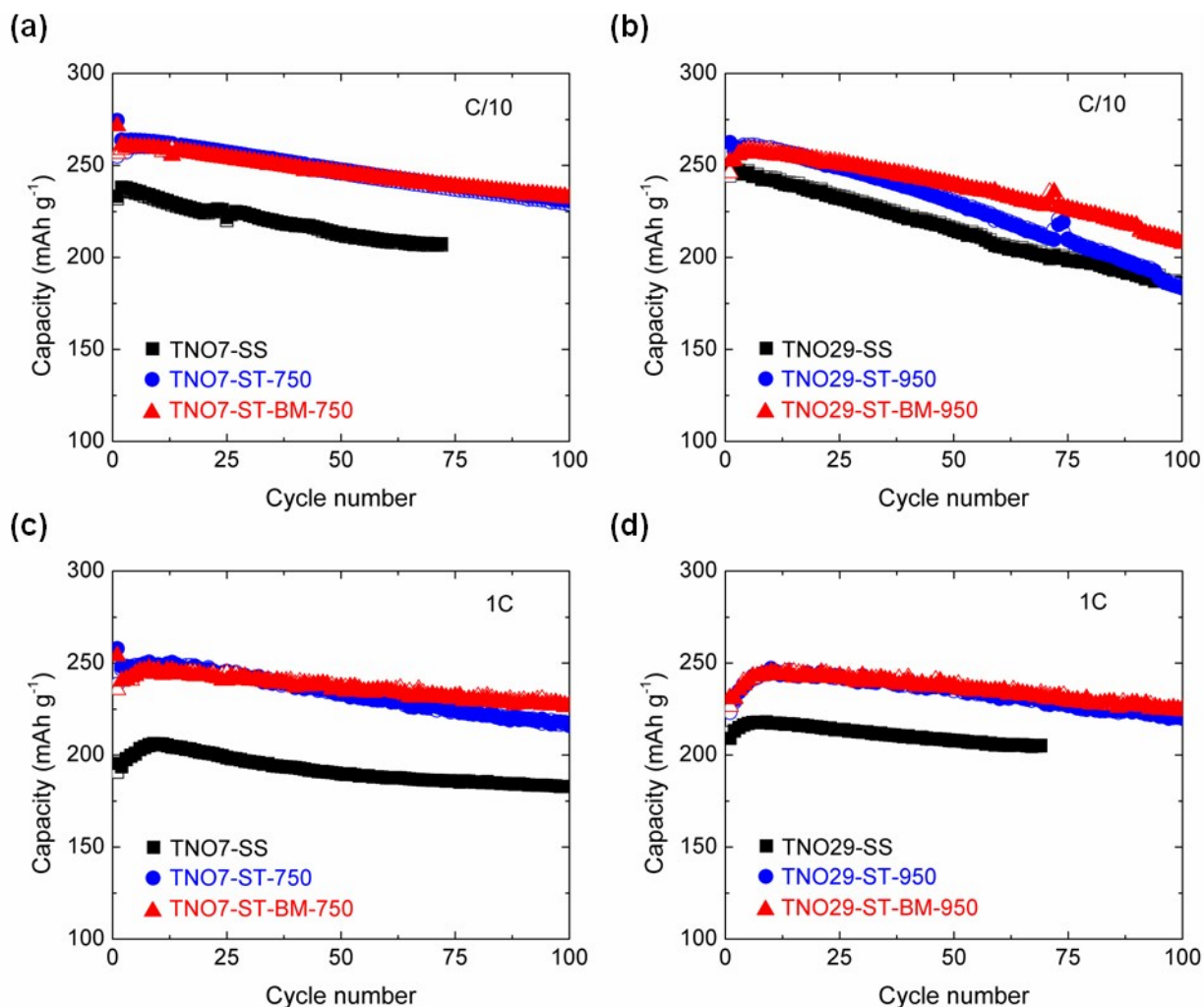
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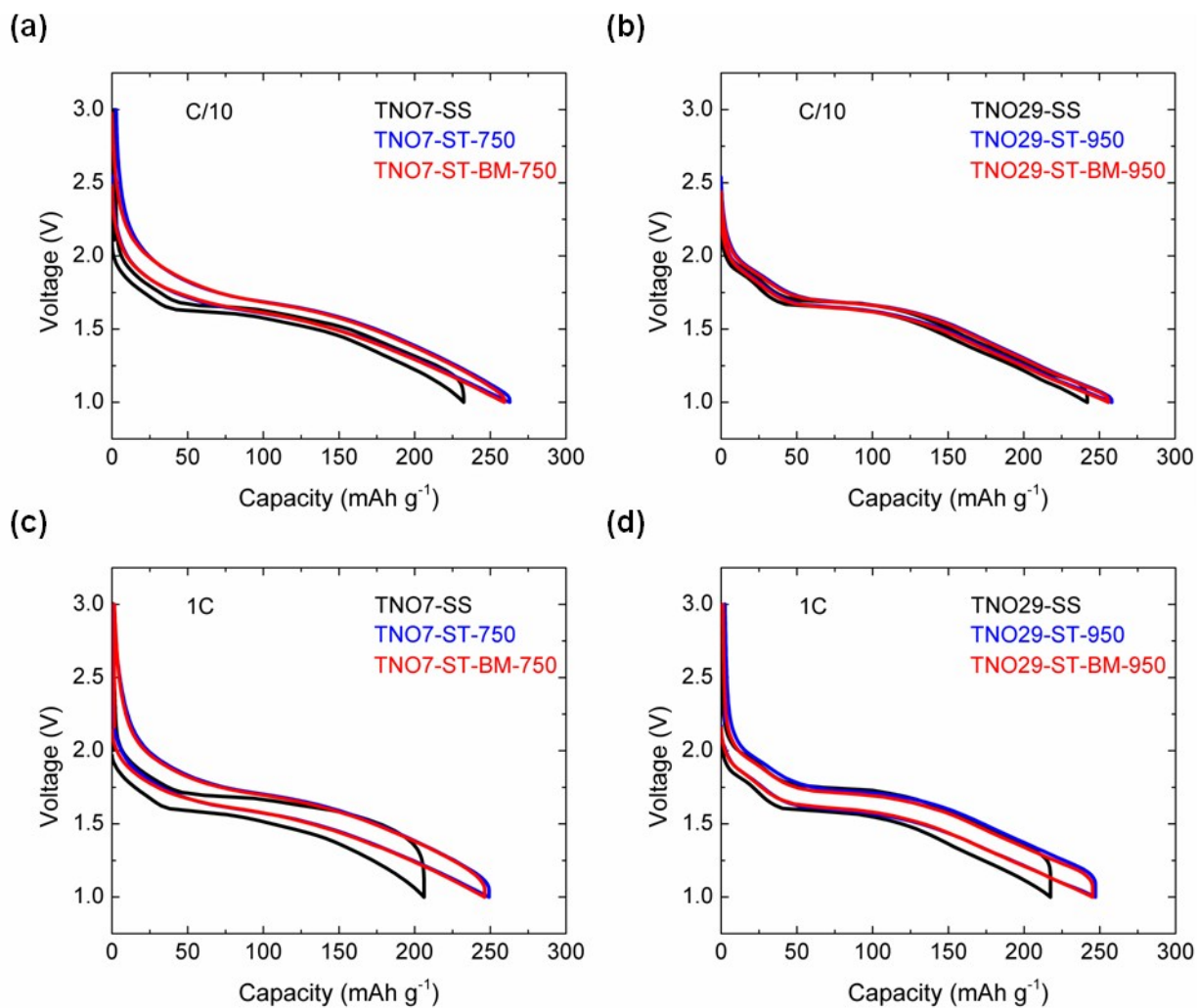
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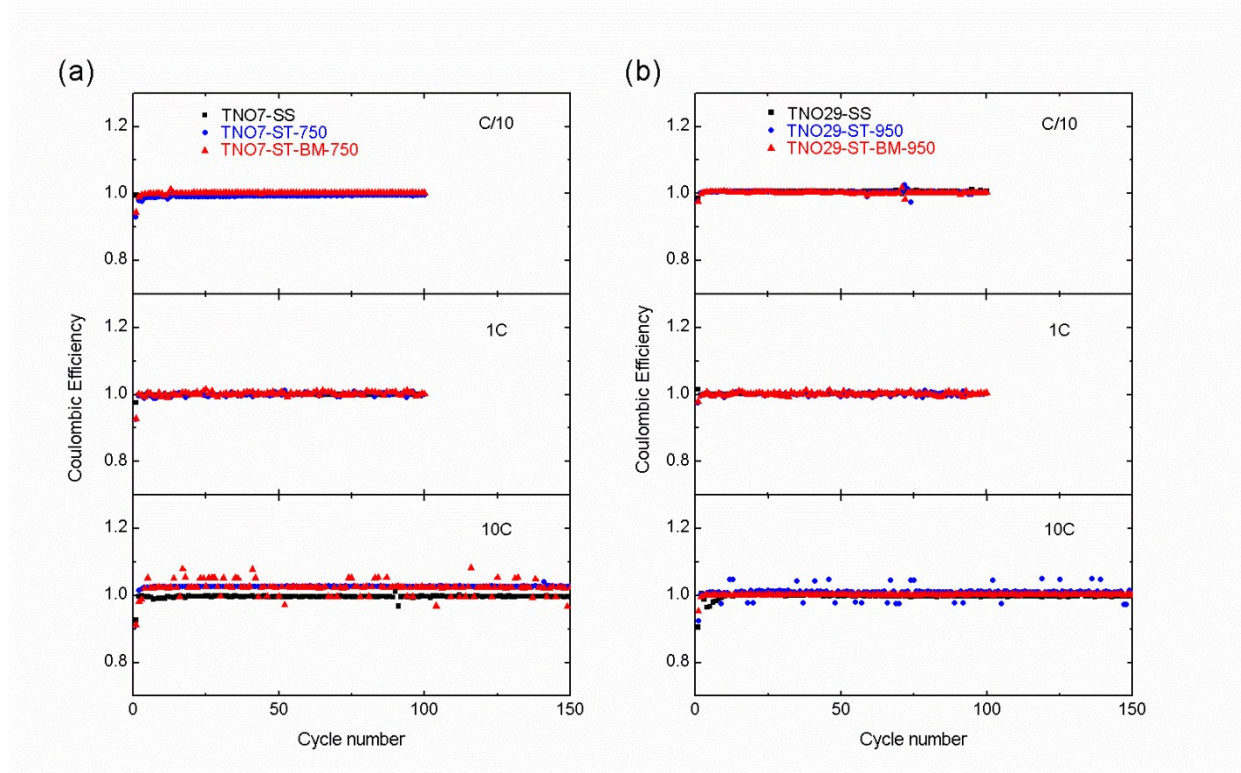
Supplemental Figure S1. SEM of TNO29-ST-BM-950 illustrating the highly interconnected 3D network of nanoparticles.



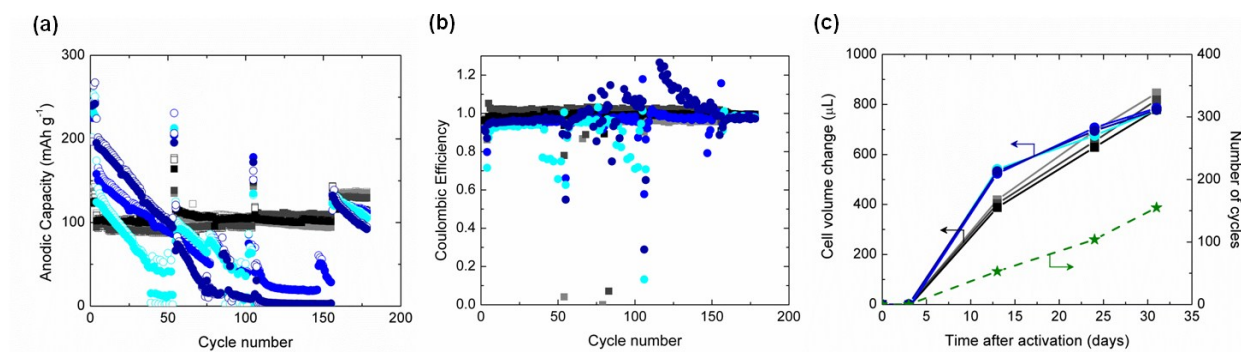
Supplemental Figure S2. Galvanostatic cycling at (a, b) C/10 and (c, d) 1C for (a, c) TNO7 and (b, d) TNO29 prepared by SS (black), ST (blue) and ST-BM (red). ST and ST-BM powders were fired at 750C and 950C for TNO7 and TNO29 respectively. Filled and open symbols are for discharge and charge respectively.



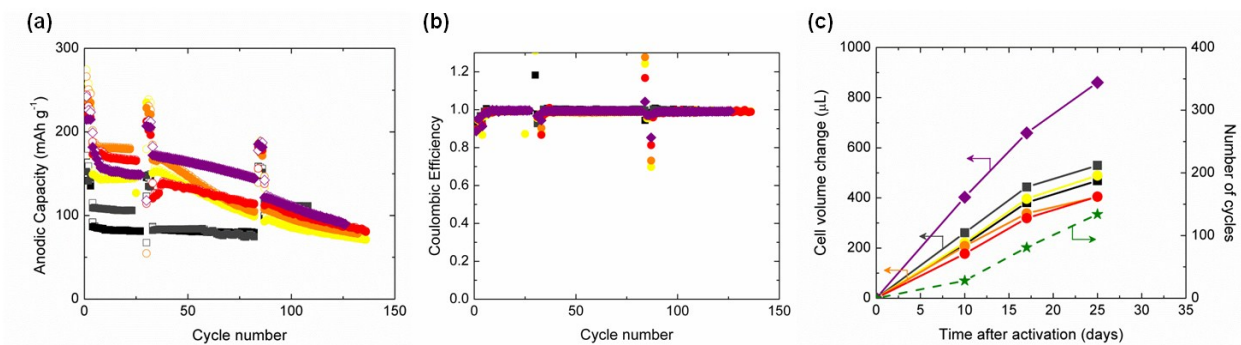
Supplemental Figure S3. Voltage profile of the 10th cycle at (a, b) C/10 and (c, d) 1C for (a, c) TNO7 and (b, d) TNO29 prepared by SS (black), ST (blue) and ST-BM (red). ST and ST-BM powders were fired at 750C and 950C for TNO7 and TNO29 respectively.



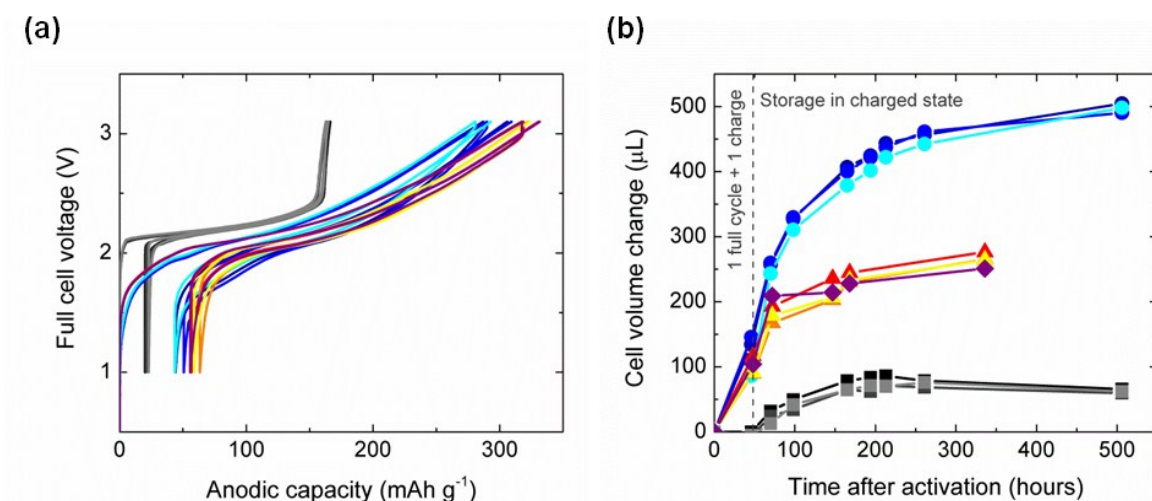
Supplemental Figure S4. Half cell Coulombic efficiency for the reported synthesis routes at various C-rates for (a) TNO7 and (b) TNO29.



Supplemental Figure S5. (a) Galvanostatic cycling, (b) Coulombic efficiency, and (c) cell volume change during cycling of LTO/LMNO (black shaded lines and squares) and TNO7-32/LMNO (blue shaded lines and circles). A cell volume measurement was taken before performing three cycles at C/10 followed by 50 cycles at 1C. This scheme was performed 3 times between 3.7 and 1.0 V and once between 3.5 and 1.5 V. Filled and open symbols are for discharge and charge respectively.



Supplemental Figure S6. (a) Galvanostatic cycling between 3.7 and 1.0 V, (b) Coulombic efficiency, and (c) cell volume change during cycling of LTO/LMNO (black shaded lines and squares), TNO7-6/LMNO (red shaded lines and circles), and asymmetric TNO7-6/LMNO (purple line and diamonds). A cell volume measurement was taken before performing three cycles at C/10 followed by 25 cycles at 1C. This scheme was performed 2 more times with 50 cycles at 1C. Filled and open symbols are for discharge and charge respectively.



Supplemental Figure S7. Full cell performances of the ten pouch cells containing a NMC cathode. (a) Voltage profile of the first cycle and second charge performed before cell storage, (b) cell volume change during storage of the charged cells at 45°C. The black shaded lines and squares represent the three LTO/NMC cells, the blue shaded lines and circles represent the three TNO7-32/NMC, the red shaded lines and triangles represent the three TNO7-6/NMC cells, and the purple line and diamond represents the asymmetric TNO7-6/NMC cell.