Supplementary Information

COMMUNICATION

Nickel titanate lithium-ion battery anode with highly reversible capacity and high-rate long-cycle life performance

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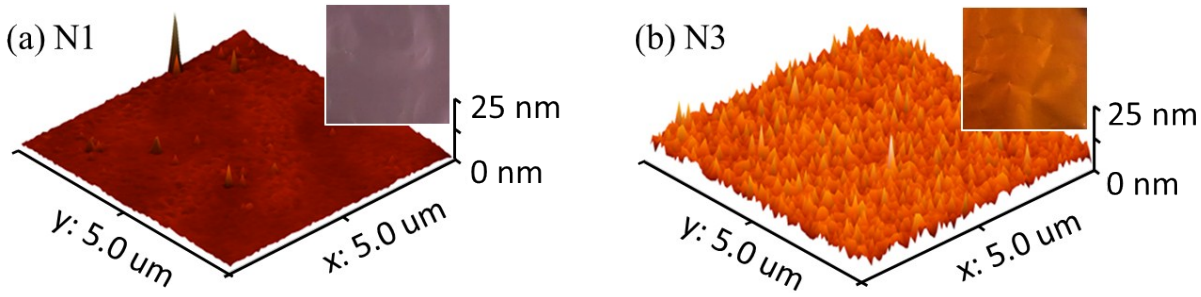

Figure S1. Atomic force microscopic (AFM) images of the nickel titanate electrode films. (a) N1 and (b) N3. The insets show the actual photo images of the films.

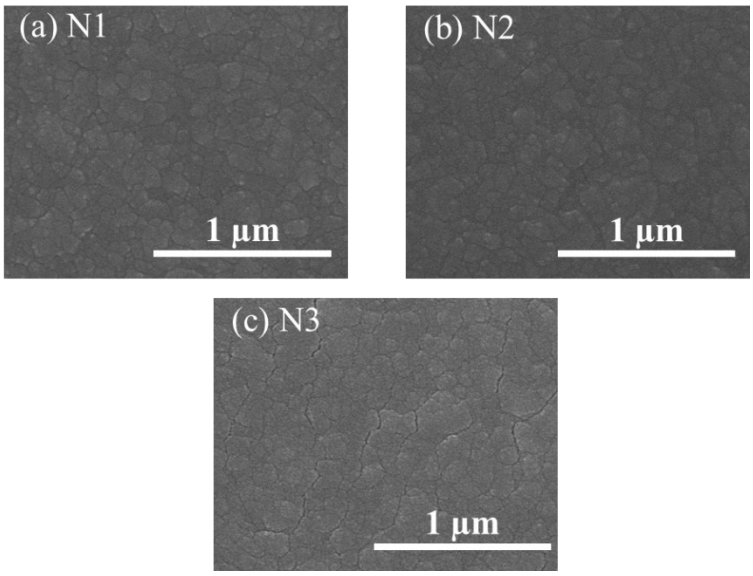

Figure S2. Field emission scanning electron microscopy (FE-SEM) images of the nickel titanate electrode films with different thicknesses. (a) N1, (b) N2 and (c) N3.

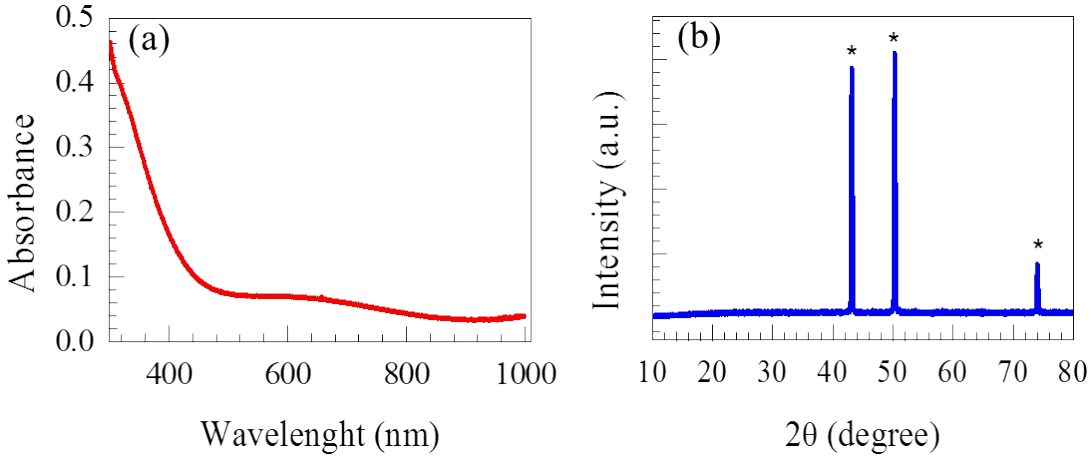

Figure S3. (a) Optical absorption spectra of the nickel titanate film (sample N2). (b) X-ray diffraction (XRD) pattern. The peaks that are indexed with star symbols are associated with the Cu substrate.

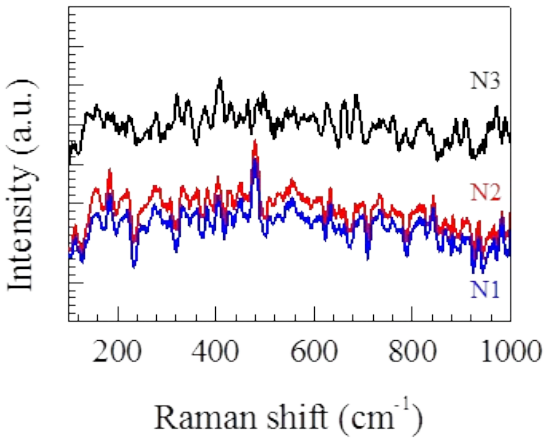

Figure S4. Micro-Raman spectra (532 nm excitation) in 150 – 900 cm^{-1} range of the nickel titanate films.

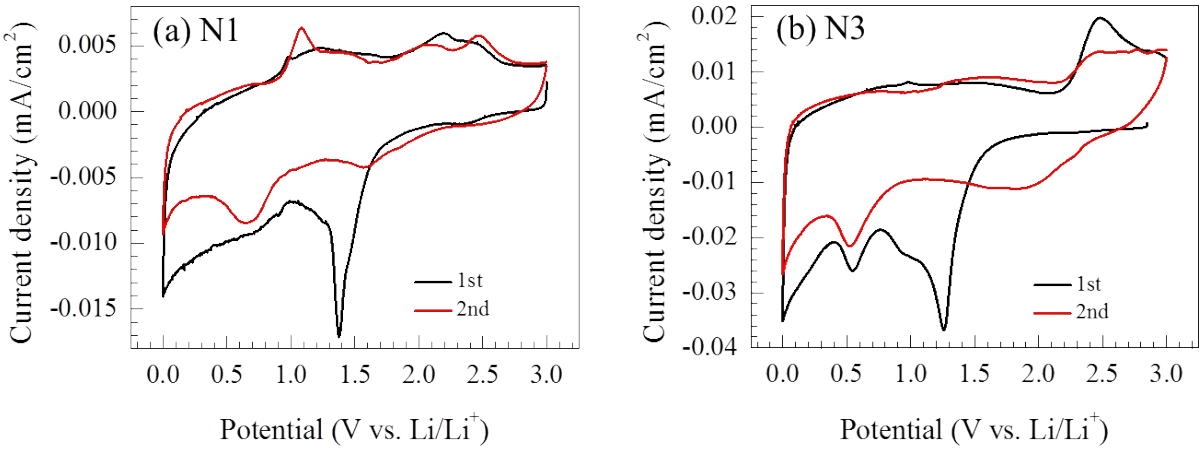

Figure S5. Cyclic voltammograms of Li/1M $LiPF_6$ in a EC:DMC/ nickel titanate half-cell collected at a scanning rate of 0.1 mV s^{-1} for the first and second cycles of the N1 and N3 electrodes.

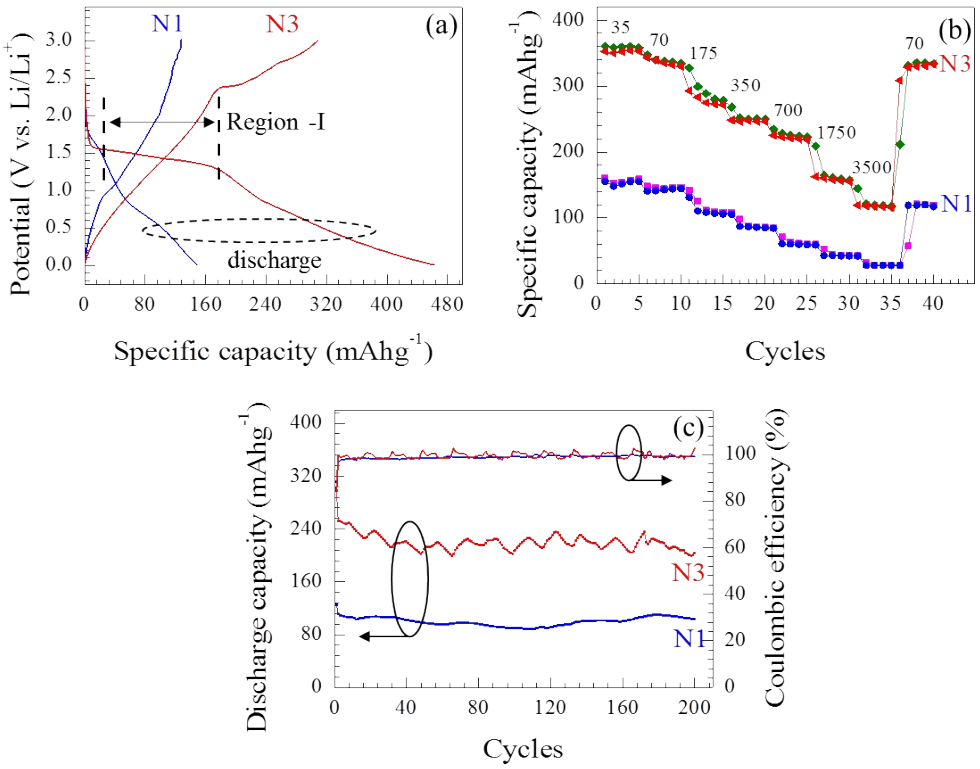

Figure S6. (a) Potential profiles of the first galvanostatic charge-discharge curve at an applied current of 100 mA g^{-1} for the N1 and N3 electrodes. (b) Cycling performance of the nickel titanate electrodes at different current rates. (c) Cycling performance and coulombic efficiency of the nickel titanate electrodes at a current density of 175 mA g^{-1} for 200 cycles.

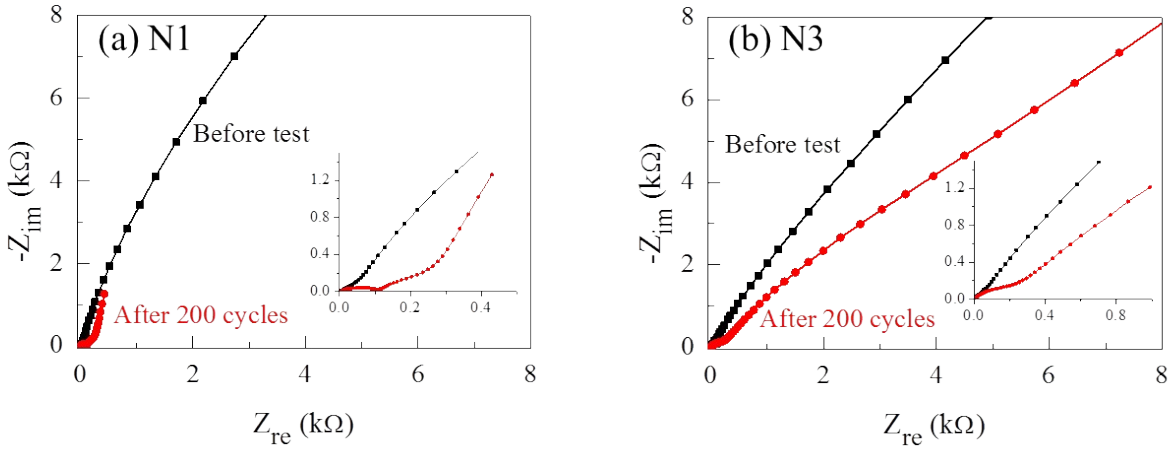

Figure S7. Nyquist plots recorded before the first discharge cycle (before test) and after the 200th charge-discharge cycle of the half-cell containing the nickel titanate electrode. (a) N1 and (b) N3. The insets show their enlarged views in the high frequency region. The black solid curves represent simulated ones using the equivalent circuits shown in Fig. 5.

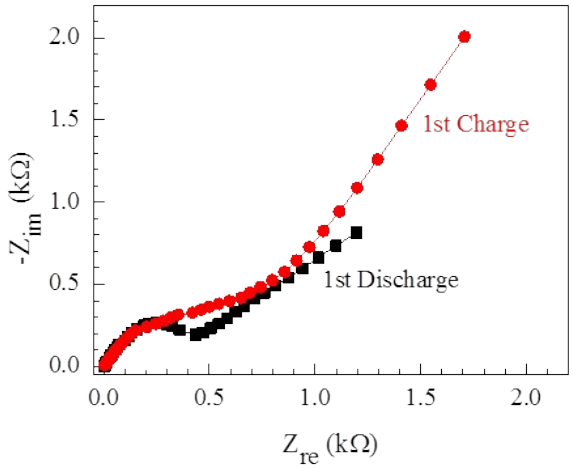

Figure S8. Nyquist plots recorded after the 1st discharge and 1st charge processes of the half-cell containing the N2 (nickel titanate) electrode during the Li-storage experiment.

	Before test			After 200 cycles		
	N1	N2	N3	N1	N2	N3
R_e (Ω)	4.730	6.48	5.876	4.002	3.17	3.510
R_s (kΩ)	49.39	10.83	8.88	0.11	0.15	0.18
R_{ct} (kΩ)	85.7	136.0	204.5	0.18	11.84	6.32
CPE1 (μF)	0.14	0.36	0.29	7.67	4.87	7.66
CPE1 (μF)	0.47	0.32	0.45	98.90	16.31	12.26
Z_w (mΩ)	-	-	-	0.329	0.324	0.272

Table S1. Impendence parameters of nickel titanate electrodes before test and after 200 cycles.

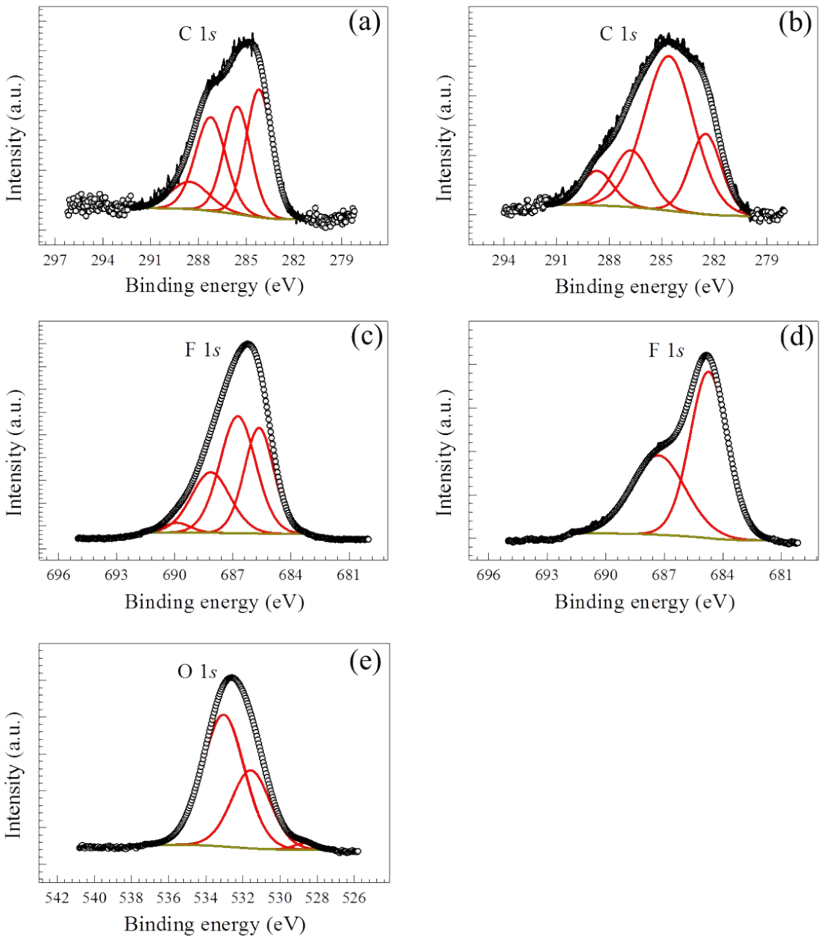

Figure S9. Core level XPS spectra of (a, b) C 1*s* and (c,d) F 1*s* for the nickel titanate electrode (N2 sample) in the discharge (a,c) and charge (b,d) states. (e) Core level XPS spectrum of O 1*s* for the nickel titanate electrode.