Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supplementary Information

Nanosized titanium niobium oxide/carbon electrodes for lithium-ion energy storage applications

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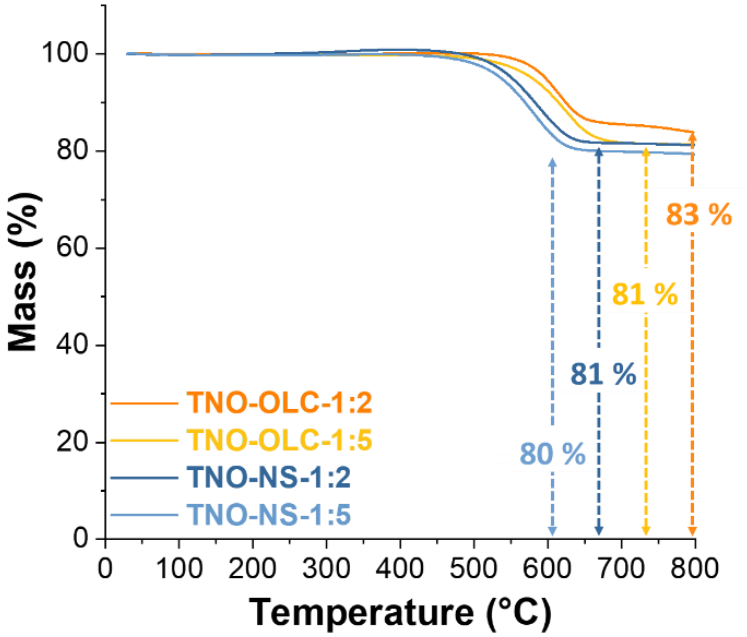

Fig. S1: Thermogravimetric analysis of samples under an air atmosphere for the characterization of the amount of carbon.

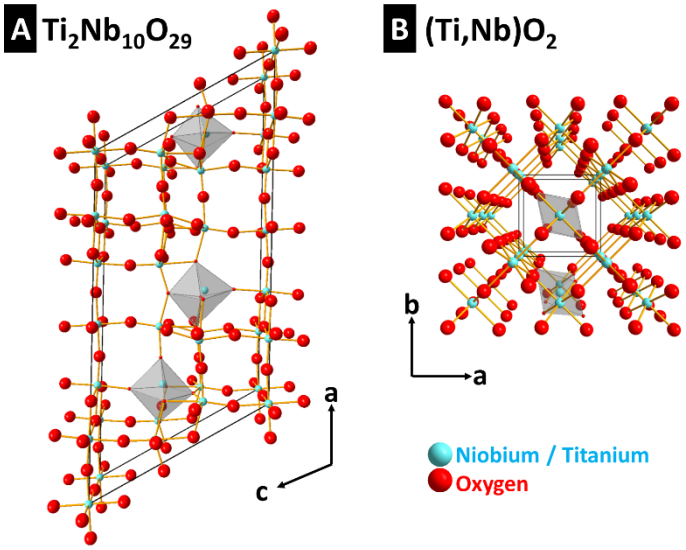

Fig. S2: Crystal structures of (A) $Ti_2Nb_{10}O_{29}$ (PDF 72-0159) and (B) rutile-type $(Ti,Nb)O_2$ (PDF 72-7371). Selected coordination octahedra of oxygen surrounding niobium / titanium are added for visualization purposes.

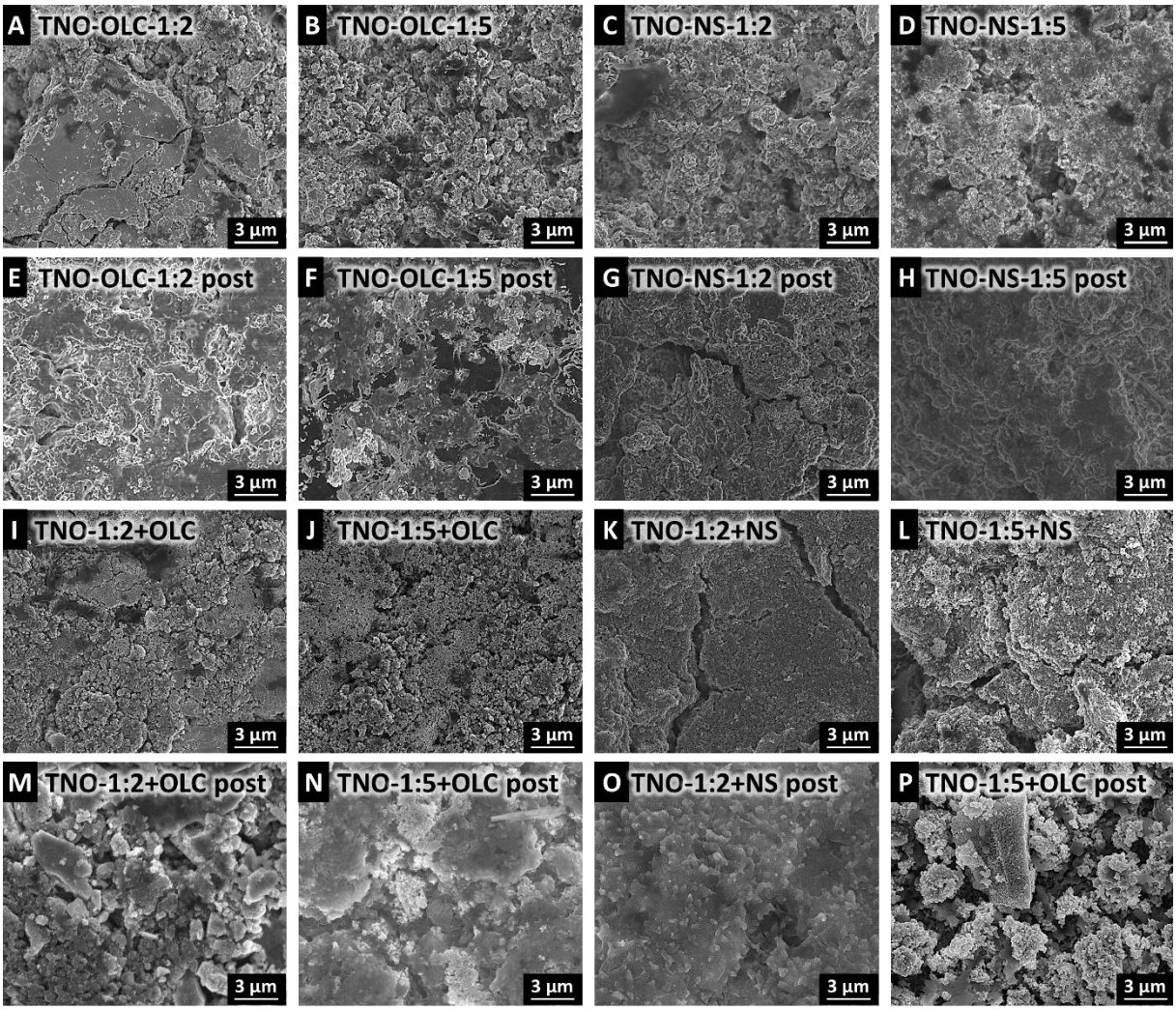

Fig. S3: Scanning electron micrographs of the hybrid and composite electrodes. The label "post" demarks samples that were investigated post-mortem, that is, after extended cycling.

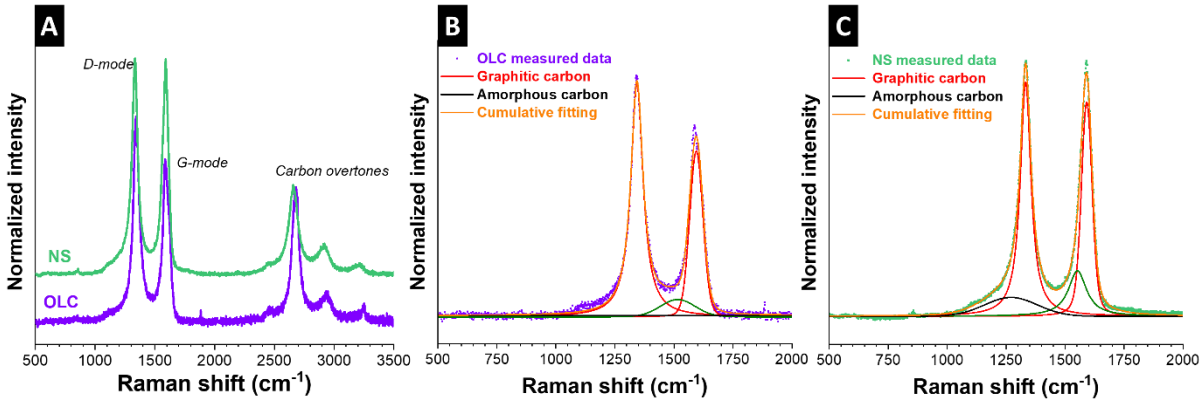

Fig. S4: (A) Raman spectra of carbon onions and carbon nanohorns. D- and G-mode peak fitting for (B) carbon onions and (C) carbon nanohorns.

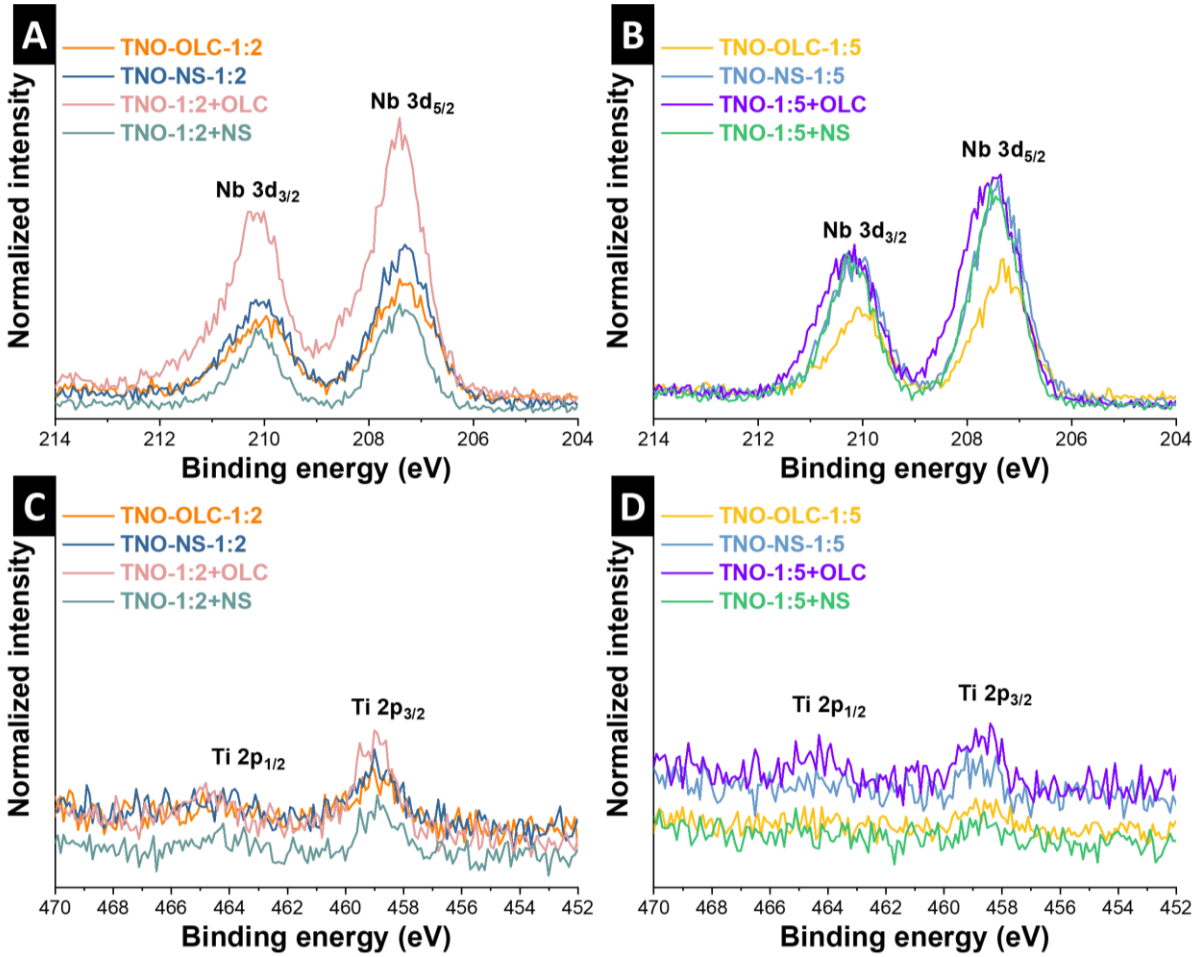

Fig. S5: The XPS spectra of (A-B) Nb 3d and (C-D) Ti 2p for TNO-C hybrid and TNO+C composite electrodes.

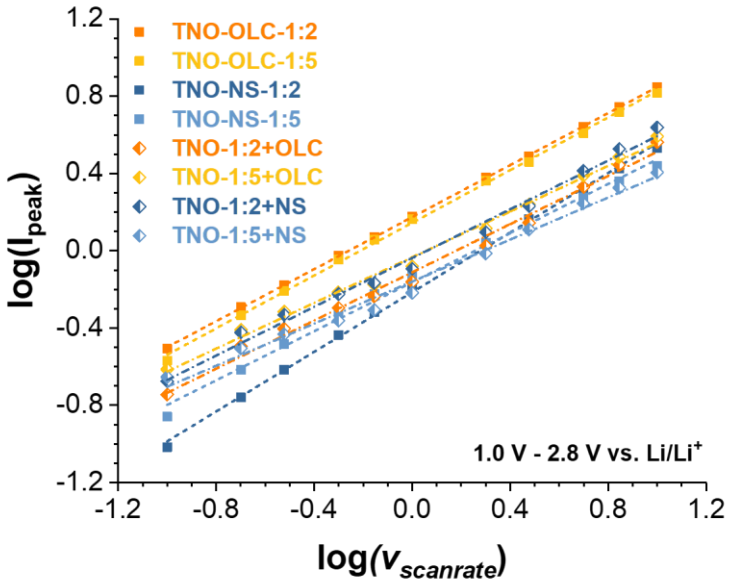

Fig. S6: Plot of log(*scan rate*) vs. log(*peak current*) of the lithiation (cathodic) in the potential range 1.0-2.8 V vs. Li/Li^+ at scan rates of 0.1-2.0 mV/s and the linear fitting of each sample.

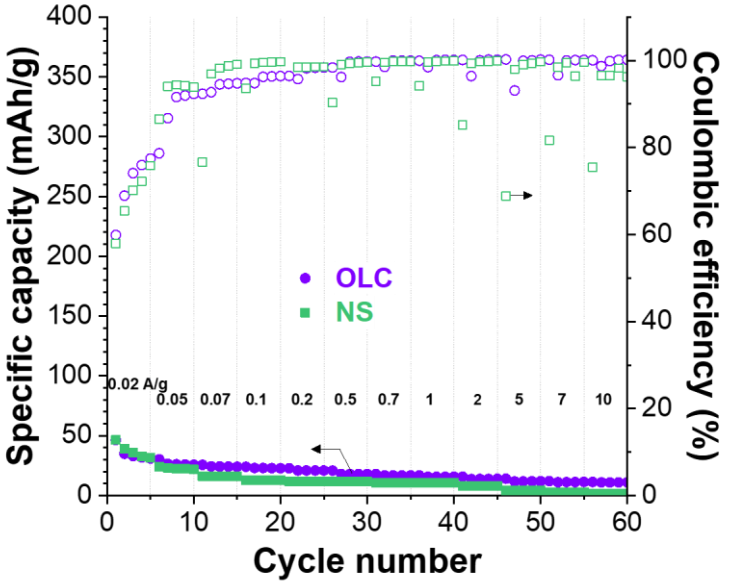

Fig. S7: The specific capacity of electrodes consisting of carbon onions (OLC) or carbon nanohorns (NS) obtained from galvanostatic charge/discharge cycling at different specific current for rate capability and their Coulombic efficiency between 1.0-2.8 V vs. Li/Li^+.

Table S1: List of the samples and their synthesis conditions according to hybridized carbon substrates.

Carbon substrate	Ti:Nb ratio of precursor	Synthesis atmosphere	Sample name
Carbon onions	1:2	Argon	TNO-OLC-1:2
	1:5	Argon	TNO-OLC-1:5
Carbon nanohorns	1:2	Argon	TNO-NS-1:2
	1:5	Argon	TNO-NS-1:5
No carbon	1:2	Air	TNO-1:2
	1:5	Air	TNO-1:5