Supplementary document

Enhanced activity of highly ordered pristine and black anodic TiO_2 nanotubes for high performance supercapacitors

Farzad Nasirpouri, Leila Jafari-Foruzin, Amirali Farmani, Elham Hosseinpour, Hassan Yadipour*

The CV data was used to calculate the specific capacitance values for various TNT based active material-coated electrodes using the following equation[1]:

$$C_s = \frac{\int I.dV}{A.s.\Delta V} \qquad (1)$$

Where C_s is the areal capacitance (in F cm^{-2}), s is the scan rate (in mV s^{-1}), ΔV is the potential window (in V) and the A is the surface area of the electrode exposed to the electrolyte. As was reported at Fig. S1(a), the areal capacitance of the black TNT (TNT-R) at a scan rate of 50 mV s^{-1} was 0.78 mF cm^{-2}, and it is significantly greater than that of TNT-1 h-30 min, TNT-4 h-30 min, and TNT-4 h-1h. The highest value of areal capacity obtained for TNT-R which is due to the decrease of the band gap energy owing to the microstructural defects such as oxygen vacancies[2, 3]. **Table S1** summarises the data obtained from cyclic voltammetry for calculated the areal capacitance. Also, the variation of areal capacitance of TNT-R as a function of potential scan rate is reported in **Fig.S1 (b)**. The areal capacitance of TNT-R decreases when the scan rate increases. The areal capacitance of TNT-R is decreased from 1.40 to 0.43 mF cm^{-2} with increasing the scan rate from 2 to 100 mV s^{-1}. [4]

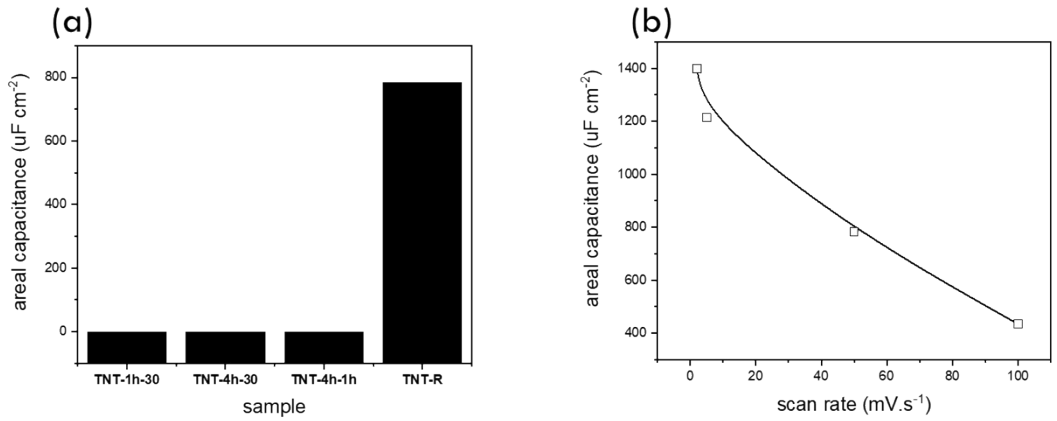

Fig S (a) the calculated capacitance for different electrodes at scan rate 50 mV s^{-1} **and (b)** the areal capacitance of TNT-R at scan rate 2, 5, 50 and 100 mV s^{-1}

Table 1. Areal capacity of different electrodes at scan rate 50 mV s^{-1} (obtained from CV)

Electrode	Areal capacitance (uF cm^{-2}) obtained from CV
TNT-1 h-30 min	0.00285
TNT-4 h-30 min	0.00181
TNT-4 h-1h	0.00355
TNT-R	783.76549

1. M. Kumar, S. Polaki and S. Dhara, *Journal of Energy Storage*, 2024, **79**, 110160.
2. S. Kalathil, M. M. Khan, S. A. Ansari, J. Lee and M. H. Cho, *Nanoscale*, 2013, **5**, 6323-6326.
3. Q. Kang, J. Cao, Y. Zhang, L. Liu, H. Xu and J. Ye, *journal of materials chemistry A*, 2013, **1**, 5766-5774.
4. C. Zhang, S. Xu, D. Cai, J. Cao, L. Wang and W. Han, *Electrochimica Acta*, 2020, **330**, 135277.