Electronic Supplimentary Information

TiO_2 fiber/particle nanohybrids as efficient anodes for Lithium-ion batteries

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Determination of capacitive contribution to the total charge stored

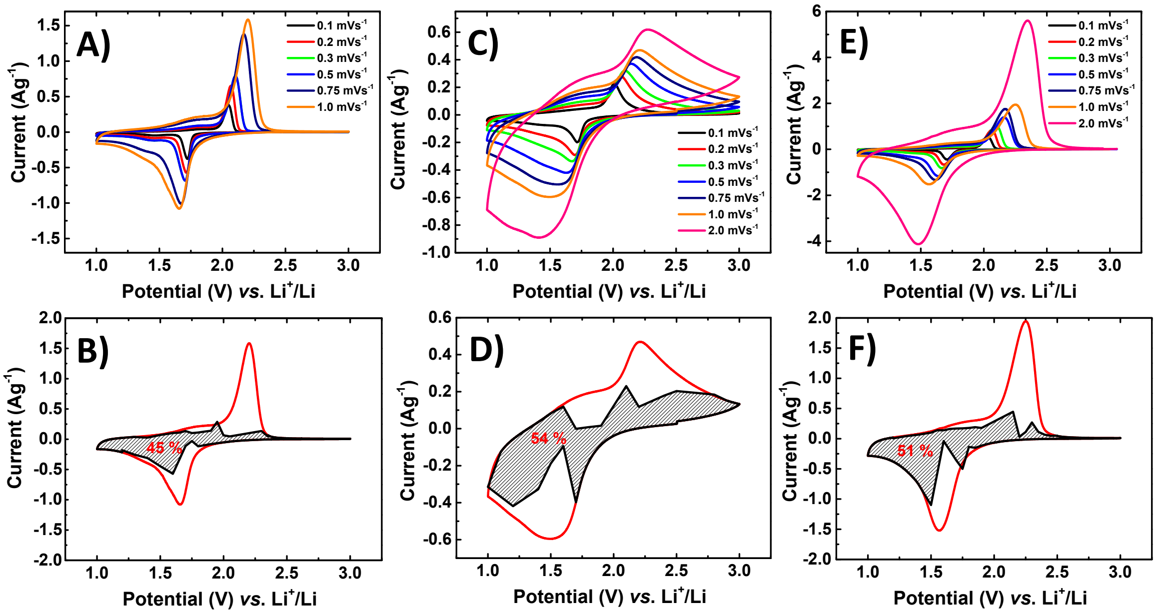

Fig. S1 Voltammetric responses of TiO_2 based electrodes when cycled at scan rates of 0.1-2.0 mVs^{-1}. A, C& E show the CV of TiO_2 particles, fibres and fibre/particle composite respectively, at different scan rates specified and B, D & F show the capacitive current contribution (shaded area) to the total current for TiO_2 particles, fibres and fibre/particle composite respectively obtained by cyclic voltammetry at 1 mVs^{-1}.

Capacitive effects in the charge storage process can be characterized by analysing cyclic voltammograms at various scan rates. Cyclic voltammograms of TiO_2 based electrodes were obtained at various scan rates of 0.1, 0.2, 0.3, 0.5, 0.75, 1.0, 2.0 mVs^{-1} as shown in **Fig. S1 A, C & E**. The cyclic voltammetric current is assumed to obey a power-law relationship

$$i = av^b \qquad \rightarrow (1)$$

where i the measured current, v sweep rate, a and b are the adjustable parameters. The value of b determines two well-defined conditions: for b = 0.5, the current is controlled by semi-infinite linear diffusion, which indicates a faradaic intercalation process and for b =1 designate for capacitive response where the current is surface-controlled aas represented in **Fig. S2**.

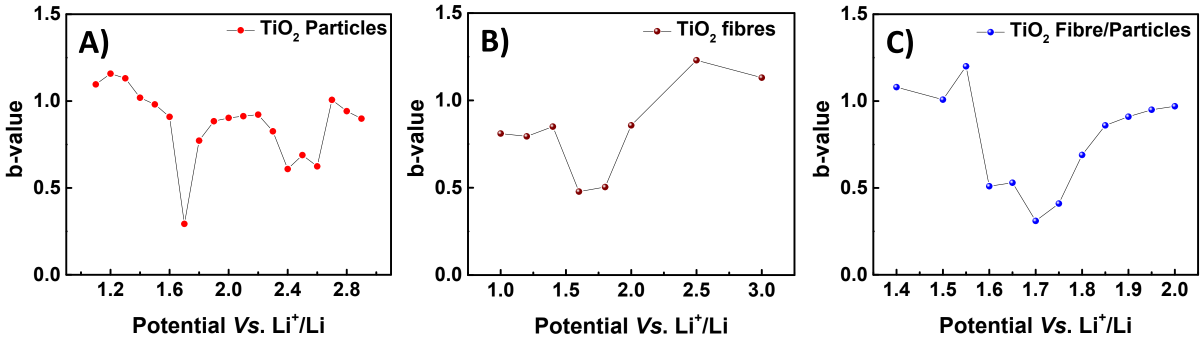

Fig. S2 A-C) represnt the b-value at different potentials during the cathodic sweep for various electrodes based on TiO_2 particles, fibres and particle/fibre composites respectively.

At a fixed potential the power law can be divided into two parts:

$$i(V) = k_1 v + k_2\, v^{1/2} \qquad \rightarrow (2)$$

where $k_1 v$ and $k_2\, v^{1/2}$ are the current contributions due to capacitive and diffusion-controlled intercalation processes respectively and 'v' be the scan rate.

By rearranging, we get

$$\frac{i(V)}{v^{\frac{1}{2}}} = k_1\, v^{1/2} + k_2 \qquad \rightarrow (3)$$

an equation resembling a straight line with slope 'k_1' and intercept 'k_2'. From the plot of $\frac{i(V)}{v^{\frac{1}{2}}}$ as a function of $v^{1/2}$ we can calulate the coefficients 'k_1' and 'k_2' from the 'slope' and '*y*-interscept' of the straight line plot respectively. Upon sbstitting k_1& k_2 in equation (2) we can seaprate the the capacitive current and diffusion current each other (**Fig. S1B, D & F**).

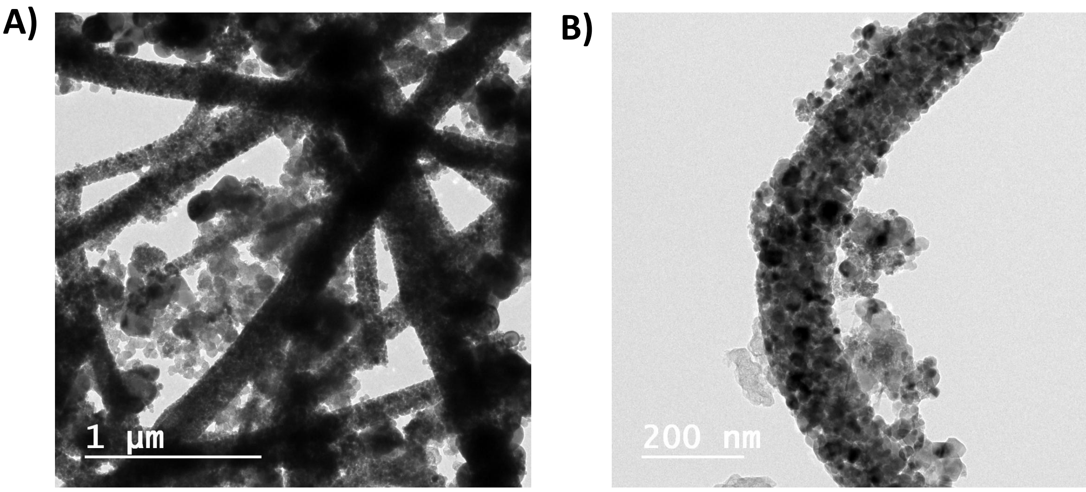

Fig. S3 TEM analysis of the spent cell fabricated using TiO_2 particle/fibre composite electrode. (**A**) and (**B**) show the low and high resolution TEM image of the TiO_2 particle/fibre composite after the galvanostatic cycling.