MXene-templated hierarchical polyaniline nanocomposites for high-performance capacitive energy storage

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Nanocomposite electrode with synergistic effect of the properties of individual components have attracted great attention in the energy storage field.[1] MXenes are a rapidly expanding family of 2D transition metal carbides, nitrides and carbonitrides. A unique combination of metallic conductivity, high aspect ratio and hydrophilic surface renders them as a promising nanofiller in multifunctional polymer nanocomposites.[2,3,4]. We developed a hierarchical nanocomposite of 2D MXene template in combination with one-dimensional polyaniline (PANI) nanowires by in-situ polymerisation and employed them as supercapacitor electrode. The MXene/PANI in aqueous electrolyte has shown synergistically remarkable electrochemical capacitance than MXene and better cycling stability than pure PANI. The specific capacitance can reach as high as 461 F/g at a discharge current density of 0.2 A/g and 90% capacitance retention after 5000 charge-discharge cycles. This study provides further insights in to the preparation of functional nanocomposites by combining different dimensional nanomaterials for the next generation of energy-storage devices.

References

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Figures

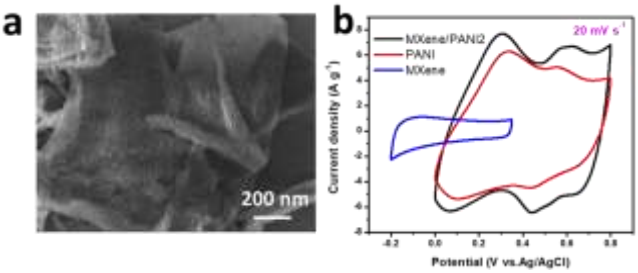

Figure 1: a) SEM image of MXene ($Ti_3C_2T_x$) / PANI 2. b) Comparison of the CV curves of ($Ti_3C_2T_x$), PANI and $Ti_3C_2T_x$/PANI 2 at a scan rate of 20 mV s^{-1}.

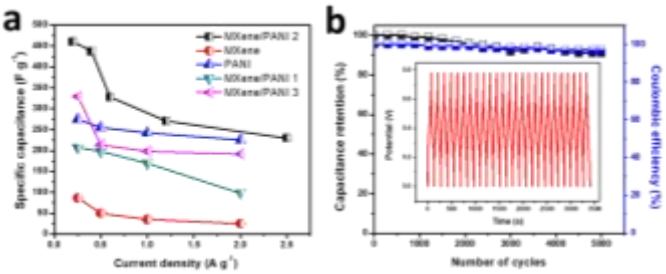

Figure 2: a) Specific capacitances of $Ti_3C_2T_x$, PANI and $Ti_3C_2T_x$/PANI 1-3 electrodes at various scan rates. b) Cycling stability and coulombic efficiency of $Ti_3C_2T_x$ /PANI 2 over 5000 cycles at a current density of 2.5 A g^{-1}.