Black TiO_2 nanofibers as highly conductive electrode materials for sodium-ion batteries

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Sodium ion batteries have been spotlighted recently due to lower material costs, the abundance of sodium resources, and analogous electrochemical components with existing Li-ion battery systems. White anatase TiO_2 nanomaterials have been developed for suitable anode materials enabling facile insertion/extraction of Na ions. However, low electronic conductivity originated from large electronic band gap (~3.2eV) and narrow interstitial sites to accommodate large Na ions often limit the battery performance. In this regard, new class of TiO_2 material called 'black TiO_2' is more attractive owing to its flexible structural feature and narrower band gap of approximately 2.2eV and consequent high electrical conductivity. In this work, we report highly conductive black TiO_2 nanofiber electrode for high performance Na-ion batteries. The introduction of black TiO_2 offer benefits; (1) formation of oxygen vacancy as numerous defective sites leads to fast electron transfer in the structure (2) the glassy structure provides efficient intercalation of Na-ions in the structure. We also elucidate thermal effects on the structural and chemical feature of the samples.