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VANADIUM NITRIDE NANOPARTICLES ENCAPSULATED IN CARBON SHEETS FOR STABLE HIGH ENERGY LITHIUM ION ANODES

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Developing novel anode materials with im-proved capacity performance is essential to the development of lithium ion battery. Va-nadium nitride (VN) material have been widely investigated recently as promising anode material for lithium ion battery. However, the volume expansion which would severely affect the cycling stability and cycle life is the main problem to be faced with. In the research, uniform VN nanoparticles encapsulated in carbon sheets (VN/C) for a stable high energy lithium ion anode have been successfully synthesized by a facile solution combustion method combined with a thermal treatment at 600 oC under ammonia atmosphere. The as-synthesized VN/C sample exhibits a 2D nanosheet structure, in which small VN na-noparticles encapsulated in carbon nanosheets. The unique structure not only provides a large quantity of accessible active sites for lithium ion insertion/extraction along with good conductivity and short transport path for both electrons and lithium ions, but also can effectively circumvent the volume expansion/contraction associated with lithium insertion/extraction. As anode material for lithium ion battery, the VN/C sample presents high reversible lithium storage capacity (712 mAh g^{-1} at 0.1 A g-1 after 100 cycles, 648 mAh g^{-1} at 1 A g^{-1} af-ter 500 cycles), high Coulombic efficiency (~99%), excellent cycling stability and good rate capability. In addition, the approach reported in this work is also applicable to other metal nitride nanoparticles encapsu-lated in carbon nanosheets, which may find important applications as electrodes, cata-lysts, adsorbents, and sensors in many dis-ciplines.

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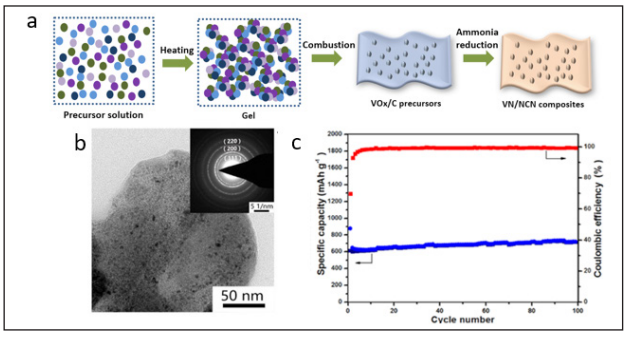

Figure 1: (a) Schematic illustration of the VN/C composites fabrica-tion,(b) TEM im-ages of the VN/C sample,(c) Cycling per-formance of the VN/C samples performed at a current density of 0.1 A g-1