Reduced graphene oxide/vanadium oxide nanobelts as a cathode material for lithium-ion battery

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Vanadium pentoxide has been attractive due to its relatively high theoretical capacity of 294 mAh/g and layered crystal structure as a host for reversible Li^+ intercalation/de-intercalation1. Herein, we show that the reduced graphene oxide/V_2O_5 nanobelts (rGOVONB) are a promising candidate for cathode material of high performance Li-ion batteries (LIBs). The rGOVONB were synthesized by microwave-assisted hydrothermal method followed by thermal annealing under nitrogen atmosphere at variable temperatures (573, 673, and 773K). One-dimensional V_2O_5 nanobelts were formed in the presence of graphene oxide (GO), which also enhanced the conductivity of rGOVONB. GO played a significant role as a mild oxidizing agent for the formation of nanobelts. The existence of rGO into the layered V_2O_5 crystal structure was confirmed by electron energy loss spectroscopy (EELS) analysis. The point EELS spectrum clearly showed the strong carbon signal. The electrochemical properties of rGOVONBs as cathode materials were investigated for LIBs. The rGOVONB annealed at 773 K exhibited a high capacity of 225 mAh/g at a current density of 40 mA/g and showed better electrochemical performance with a capacity of 137 mAh/g after 70cycles at the current density of 800 mA/g in comparison to the other rGOVONBs and the pristine materials. This study provides a simple and efficient route for 1D cathode materials through a microwave-assisted hydrothermal method.

References:

[1] Yu, H. et al, Nanoscale, 5, 2013, 4937-4943