A Li_2MnSiO_4@rGO composite with enhanced electrochemical performance as cathode material for lithium-ion batteries

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.Li_2MnSiO_4 cathode material has a high theoretical capacity of 332 mA h g^{-1}, much higher than commercial $LiCoO_2$ cathode[1].However, the low practical discharge capacities due to the low electric and ionic conductivities and rapid capacity fading due to the structural instability and manganese dissolution during cycles greatly hinder its development. Great efforts have been paid to improve its eletrochemical performance, including particle size tailoring, carbon coating, and ionic doping[2,3]. Recently, graphene has been used in Li_2MnSiO_4 cathode as conductive agent and showed enhanced electrochemical properties[4].

Herein, we designed a Li_2MnSiO_4@rGO composite with ultra-fine nanoparticles as a cathode material for lithium ion batteries. The ultra-fine SiO_2 nanoparticles were first anchered into the graphene oxide sheet via a stober methode, then Li, Mn salts and carbon precursors were added and milled finely, finally the mixture were sintered under Ar protection to obtain the Li_2MnSiO_4@rGO composite. The Li_2MnSiO_4 particles can be easily controlled by tailoring the SiO_2 particles that anchored on the graphene oxide, thus we could obtain the ultra-fine Li_2MnSiO_4 particle with diameter ~40 nm anchored graphene sheet composite. The ultra-fine Li_2MnSiO_4 nanoparticle and graphene protection could effectively improve its electrochemical reaction kinetics and structural stability.The Li_2MnSiO_4@rGO composite delivers a high discharge capacity of 175 $mAhg^{-1}$ and keeps a high capacity retention of 85.7% after 25 cycles at a current density of 10 mA g^{-1}.

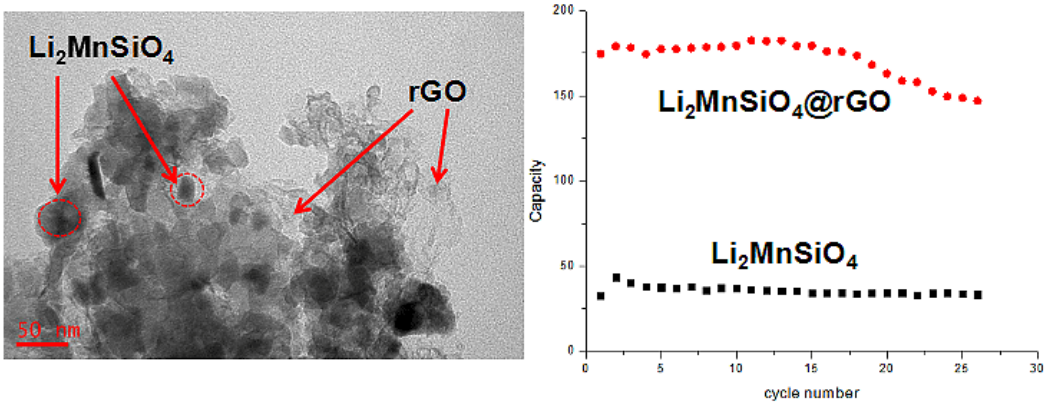

Fig.1 The TEM image and cycling performance of the Li_2MnSiO_4@rGO composite

Reference to a journal publication:
[1]A. Nyten, A. Abouimrane, M. Armand, T. Gustafsson, J.O. Thomas, Electrochem.Commun. 7 (2005) 156-160.
[2]S. Liu, J.Xu, D. Li, Y. Hu, X. Liu, K. Xie.Journal of Power Sources 232 (2013) 258-263
[3]Y.X. Li, Z.L. Gong, Y. Yang, J. Power Sources 174 (2007) 528-532.
[4]Z. Hu, K. Zhang, H. Gao, W. Duan, F. Cheng, J.Liang, J. Chen.J. Mater. Chem. A, 2013, 1, 12650