Nano-Micro Conference

Abstract View Online

Low Dimensional Materials Used for Lithium/Sodium ion Battery Anode

Gaoxiang Wu, Xiaodan Li, Jiewei Chen, Yanjiao Guo, Bi Luo, Bing Jiang, Lihua Chu, Meicheng Li*

State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, School of Renewable Energy, North China Electric Power University, Beinong Road 2, Beijing 102206, China

Corresponding Author. Email: mcli@ncepu.edu.cn

Received: 05 June 2017, Accepted: 19 June 2017, Published Online: 21 October 2017

Citation Information: Gaoxiang Wu, Xiaodan Li, Jiewei Chen, Yanjiao Guo, Bi Luo, Bing Jiang, Lihua Chu, Meicheng Li, Nano-Micro Conference, 2017, 1, 01035 doi: 10.11605/cp.nmc2017.01035

Abstract

The exploitation of high-performance lithium ion batteries is an effective way to promote the practicality of electric vehicles and the large scale development of renewable energy. We have designed and used a low temperature solution approach which is simple, low cost, scalable to synthesize Zn_2GeO_4/g-C_3N_4 hybrid structure. Furthermore the synergistic effect on their lithium storage has been discussed. The Zn_2GeO_4/g-C_3N_4 hybrids exhibited highly reversible capacity of 1370 mA h g^{-1} at 200 mA g^{-1} after 140 cycles and excellent rate capability of 950 mA h g^{-1} at 2000 mA g^{-1}. On the other hand, molybdenum sulfide, one of the transition metal sulfides, has been considered as a hopeful anode material, because of the small volume change (~103%) and the high theoretical capacity (669~1675 mA h g^{-1}). In order to improve the electrochemical properties of molybdenum sulfide, we have designed and prepared TiO_2@MoS_2 core-shell structure. This composite structure provides a plenty of surface active sites for rapid transportation of lithium ions and orderly path for electrons. As a result, the electrochemical performance of TiO_2@MoS_2 is much higher than that of molybdenum sulfide as well as titanium dioxide. In addition, transition metal oxides also have been attracted widespread attention, because of it versatile nanostructures, high theoretical capacity and small volume change. We have synthesized 3D NiO microsphere architecture assembled from porous nanosheets via easy hydrothermal method. The advantage of large specific surface area endows the as-prepared 3D NiO microspheres with a good performance of stable and high reversible discharge capacity up to 820 mA h g^{-1} even after 100 cycles at a current density of 100 mA g^{-1}, and good rate capability of 634 mA h g^{-1} at a high current density of 1 A g^{-1}.

References

[1] Xiaodan Li; Gaoxiang Wu; Xin Liu; Wei Li; Meicheng Li, Orderly integration of porous TiO_2(B) nanosheets into bunchy hierarchical structure for high-rate and ultralong-lifespan lithium-ion batteries. Nano Energy. 31, 1-8 (2017). doi:10.1016/j.nanoen.2016.11.002

[2] Xiaodan Li; Gaoxiang Wu; Jiewei Chen; Meicheng Li; Wei Li; Tianyue Wang; Bing Jiang; Yue He; Liqiang Mai, Low-crystallinity molybdenum sulfide nanosheets assembled on carbon nanotubes for long-life lithium storage: Unusual electrochemical behaviors and ascending capacities. Applied Surface Science. 392, 297-304 (2017). doi:10.1016/j.apsusc.2016.09.055

[3] Lihua Chu; Meicheng Li; Yu Wang; Xiaodan Li; Zipei Wan; Shangyi Dou; Yue Chu, Multishelled NiO Hollow Spheres Decorated by Graphene Nanosheets as Anodes for Lithium-Ion Batteries with Improved Reversible Capacity and Cycling Stability. Journal of Nanomaterials. 2016, 4901847 (2016). doi:10.1155/2016/4901847

[4] Xiaodan Li; Yi Feng; Meicheng Li; Wei Li; Hao Wei; Dandan Song, Smart Hybrids of Zn_2GeO_4 Nanoparticles and Ultrathin g-C_3N_4 Layers: Synergistic Lithium Storage and Excellent Electrochemical Performance. Advanced Functional Materials. 25 6858-6866 (2015). doi:10.1002/adfm.201502938

[5] Xiaodan Li; Wei Li; Meicheng Li; Peng Cui; Dehong Chen; Thomas Gengenbach; Lihua Chu; Huiyuan Liu; Guangsheng Song, Glucose-assisted synthesis of the hierarchical TiO_2 nanowire@MoS_2 nanosheet nanocomposite and its synergistic lithium storage performance. Journal of Materials Chemistry A. 3, 2762-2769 (2015). doi:10.1039/C4TA05249H

[6] Peng Cui; Bixia Xie; Xiaodan Li; Meicheng Li; Yaoyao Li; Yu Wang; Zhuohai Liu; Xin Liu; Jing Huang; Dandan Song; Joseph Michel Mbengue, Anatase/TiO_2-B hybrid microspheres constructed from ultrathin nanosheets: facile synthesis and application for fast lithium ion storage. CrystEngComm. 17, 7930-7937 (2015). doi:10.1039/C5CE01600B

[7] Lihua Chu; Meicheng Li; Xiaodan Li; Yu Wang; Zipei Wan; Shangyi Dou; Dandan Song; Yingfeng Li; Bing Jiang, High performance NiO microsphere anode assembled from porous nanosheets for lithium-ion batteries. RSC Advances. 5, 49765-49770 (2015). doi:10.1039/C5RA05659D