

论文摘要

中国有色金属学报

ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO

第19卷 第8期 (总第125期) 2009年8月

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文章编号: 1004-0609(2009)08-1462-06

三价铁源对碳热还原法制备 LiFePO_4/C 结构和性能的影响

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摘要: 以有机(柠檬酸铁)和无机(Fe_2O_3 或 Fe_3O_4)三价铁混合物为铁源, 以有机铁源中的有机酸根为碳源和还原剂, 通过固相-碳热还原法制备 LiFePO_4/C 正极材料, 考察无机三价铁源对正极材料结构和性能的影响。采用XRD、SEM和恒流充放电测试等方法对正极材料的结构、表观形貌及电化学性能进行研究。结果表明: 以 Fe_2O_3 为无机三价铁源合成的 LiFePO_4/C 材料的晶相单一、晶粒尺寸较小、电化学性能较好, 以0.1C放电时, 其第三次放电比容量达136 mA·h/g, 循环20周后基本无衰减; 而由 Fe_3O_4 为铁源制得的材料中含有其它杂质相, 晶粒尺寸较大, 电化学性能较差, 以0.1C放电倍率放电时, 其第三次放电比容量仅为118 mA·h/g, 循环20周后衰减近17%。

关键字: LiFePO_4 ; 锂离子电池; 正极材料; 碳热还原法; 三价铁源

Effects of Fe^{3+} sources on structure and properties of LiFePO_4/C prepared by carbothermal reduction method

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Abstract: LiFePO_4/C cathode material were synthesized by solid state-carbothermal reduction method using organic (citrate ferric) and inorganic (Fe_2O_3 or Fe_3O_4) trivalent iron compounds as iron precursors and using the organic acid radical in organic iron precursor as both reducing agent and carbon source. The influences of inorganic Fe^{3+} sources on the structures and performances of the material were investigated. The structure, morphology and electrochemical properties of LiFePO_4/C were analyzed by XRD, SEM and galvanostatic charge-discharge method, respectively. The results indicate that the sample synthesized by Fe_2O_3 has fine particle size, single crystal structure and excellent electrochemical performances, the third

discharge capacity remains 136 mA/h·g at 0.1C with almost no capacity fading after 20 cycles. While the third discharge capacity of sample obtained from Fe₃O₄ with large particle size and some impurities is only 118 mA·h/g at 0.1C, with about 17% capacity fading after 20 cycles.

Key words: LiFePO₄; lithium ion battery; cathode material; carbothermal reduction method; trivalent iron source

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