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高密度锂离子电池正极复合材料LiFePO₄/C

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摘要: 以FeC₂O₄·2H₂O、NH₄H₂PO₄、Li₂CO₃和乙炔黑为原料, 采用两步固相反应法制备了高密度LiFePO₄/C正极复合材料。利用差热(DSC), 热重(TGA)和X射线衍射(XRD)等分析手段具体探讨了第一步固相反应中可能存在的反应过程和中间产物。利用扫描电镜表征了复合材料LiFePO₄/C中LiFePO₄微粒形貌和接触状态。结果表明, 乙炔黑的含量是影响LiFePO₄微粒尺寸和微粒间接界面重要因素。在一次热处理的基础上, 二次球磨和烧结有利于第二次固相反应过程中反应物质的接触和传质, 较一步固相法提高了生成的LiFePO₄的振实密度。当乙炔黑的含量(质量分数)为0.1%~1.5%时, 两步固相法所制正极材料LiFePO₄/C的振实密度可达到1.7 g/cm³, 初次放电容量达到105 mA·h/g。

关键字: 锂离子电池; LiFePO₄/C复合材料; 正极材料; 高密度; 两步固相反应

High density LiFePO₄/C composite cathode material for lithium ion batteries

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Abstract: High density LiFePO₄/C composite cathode material was synthesized by two-step solid state reaction using raw materials FeC₂O₄·2H₂O, NH₄H₂PO₄, Li₂CO₃ and acetylene black. The possible reactions and middle products in the first calcining process were investigated in detail by means of DSC, TGA and XRD. SEM was used to characterize the morphology and contiguity of LiFePO₄ particles in LiFePO₄/C composite material. The results show that the content of acetylene black is an important factor to influence the particle size of LiFePO₄ and the contiguity between grains. Based on the first heat treatment, the second ball milling and calcining favor the osculation and mass transfer of the reactants in the second solid state reaction, and compared with one-step method, the density of resultant LiFePO₄/C is ameliorated. With the residual acetylene black content(mass fraction) of 0.1%~1.5%, the tap density of LiFePO₄/C prepared by two-step process reaches 1.7 g/cm³, and its initial discharge capacity approximates 105 mA·h/g.

Key words: lithium ion battery; LiFePO₄/C composite material; cathode material; high density; two-step solid state reaction

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