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球磨方式对锂离子正极材料$LiFePO_4$性能的影响(英文)

Effects of Ball-milling on the Preparation of $LiFePO_4$ Cathode Material for Lithium-ion Batteries

中文关键词：磷酸铁锂；球磨；粒径；正极材料；锂离子电池

英文关键词：lithium iron(Ⅱ) phosphate; ball-milling; particle size; cathode material; lithium-ion batteries

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作者	单位
唐致远	天津大学化工学院，天津 300072
高　飞	天津大学化工学院，天津 300072
薛建军	广州鹏辉电池有限公司，广州 511483

中文摘要：

采用高温固相合成法制备橄榄石型的$LiFePO_4$正极材料，在合成过程中分别采用湿法球磨和干法球磨两种球磨方式。用X-射线衍射，扫描电镜，激光粒度测试等对合成材料进行表征，并对以$LiFePO_4$为正极的电池进行电化学性能测试。结果表明，相对于干法球磨，湿法球磨制备的$LiFePO_4$样品具有更好的电化学性能，0.2C放电的首次放电比容量为134.9 $mAh \cdot g^{-1}$，并有优良的大电流放电性能及循环性能。这主要是因为采用湿法球磨制备的$LiFePO_4$材料物相较纯、粒径均匀，与导电添加剂的接触更加紧密，从而提高了$LiFePO_4$材料电化学性能。

英文摘要：

Olivine $LiFePO_4$ / C composite powders were synthesized by solid-state reaction with wet ball-milling procedure. The powder properties and the electrochemical characteristics of the prepared samples were investigated in comparison with those samples obtained by dry ball-milling. The crystal structure and the electrochemical performance were characterized by XRD, SEM, laser particle-size distribution measurement and electrochemical performance testing. The olivine $LiFePO_4$ obtained from wet ball-milling shows a maximum discharge capacity of 134.9 $mAh \cdot g^{-1}$ at the C/5 rate. The composite also displays a better rate capability, a higher charge-discharge capacity and a more stable cycle-life than those samples from dry ball-milling. The improved electrode performance of samples by wet ball-milling originates mainly from very fine particles of sub-micron size and a homogeneous surface morphology. These powder characteristics increase the surface area of $LiFePO_4$ particles and maximize the contact area with the conductor additives, resulting in enhanced electrochemical performance.

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服务热线：(025)83592307　传真：(025)83592307　邮编：210093　Email：wjhx@netra.nju.edu.cn

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