An Ionic Liquid-Present Method for Preparing Micro-sized Octahedral Particles of Co_3O_4 and Their Applications as Anode Materials for Lithium Ion Batteries

Keqiang Ding^{1,2,3*}, Xiaojing Gao¹, Jingwei Han¹, Xiangming He², Runling Qu¹, Lanjun Zhou¹, Hongmin Dou³, Hui Wang³, Li Wang^{2,*}

¹ National Demonstration Center for Experimental Chemistry Education, Hebei Key Laboratory of Organic Functional Molecules, Hebei Key Laboratory of Inorganic Nanomaterials, College of Chemistry and Material Science, Hebei Normal University, Shijiazhuang, Hebei 050024, China

² Institute of Nuclear & New Energy Technology, Tsinghua University, Beijing 100084, China

³ Hebei LingDian New Energy Technology Co., Ltd, Tangshan, Hebei, 064200, China

*E-mail: dkeqiang@263.net, wang-l@tsinghua.edu.cn

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For the first time, tricobalt tetraoxide (Co_3O_4) particles with a well-defined octahedral structure and a size more than 8 μm were prepared via an ionic liquid-present dissolving-drying-calcination method using cobaltous acetate tetrahydrate ($\text{Co}(\text{CH}_3\text{COO})_2 \cdot 4\text{H}_2\text{O}$) as the precursor in this work. Different from the previous works, a kind of ionic liquids (ILs) was employed as one main component of the preparation solution. The materials prepared in the presence of 1-butyl-3-methylimidazolium bromide, 1-butyl-3-methylimidazolium tetrafluoroborate and 1-butyl-3-methylimidazolium chloride were respectively nominated as material a, b and c. As indicated by the XRD and XPS analysis, CoO and Co_3O_4 were the major components of material a and b, and Co_3O_4 was the main substance of material c. As confirmed by the obtained SEM images, octahedral particles of Co_3O_4 with a size greater than 8 μm were prepared in material c. When being used as anode materials for lithium ion batteries (LIBs), material a, b and c at the current density of 100 mA g^{-1} exhibited an initial discharge capacity of 600, 612 and 878 mAh g^{-1} , respectively. Particularly, material c was able to deliver a discharge capacity of 336 mAh g^{-1} after 10 cycles even under the current density of 500 mA g^{-1} . A fact that octahedral particles of Co_3O_4 with a size more than 8 μm could be prepared using an ionic liquid-present method was presented in this work, which was very beneficial to the development of metal oxides based anode materials of LIBs as well as the exploration of micro-devices.

Keywords: cobaltous acetate tetrahydrate; ionic liquid; micron-sized octahedron Co_3O_4 particles; anode materials; lithium ion batteries.

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