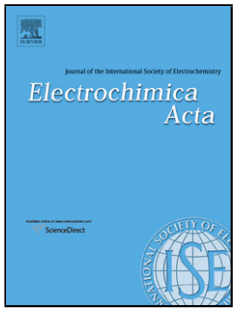

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Author: Xiaowei Miao Jun Yang Wanjing Pan Hancheng Yuan Yanna Nuli Shin-ichi Hirano

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Graphite fluoride as a cathode material for primary magnesium batteries with high energy density

Xiaowei Miao, Jun Yang*, Wanjing Pan, Hancheng Yuan, Yanna Nuli, Shin-ichi Hirano

School of Chemistry and Chemical Engineering, Shanghai Jiao Tong University
Hirano Institute for Materials Innovation, Shanghai Jiao Tong University
800 Dongchuan Road, Shanghai, 200240, China
*Email:yangj723@sjtu.edu.cn (J. Yang)

Graphite fluorides have become promising electrode materials for lithium batteries while their applications in magnesium batteries are rarely reported. Here we demonstrate for the first time $CF_{0.8}$ as a cathode material for magnesium batteries with a high discharge capacity of more than 800 mAh g^{-1}. X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS) and the charge/discharge measurements are used to characterize its structure and electrochemical performance. SEM indicates that $CF_{0.8}$ sample is a layered structure with the thickness of approximately 300~400 nm. The $CF_{0.8}$ cathode exhibits a high discharge capacity of 813.4 mAh g^{-1} after discharging to 0.5 V at 20 mA g^{-1} in 0.4 M $(PhMgCl)_2$-$AlCl_3$/THF electrolyte (named as APC/THF). Discharge product MgF_2 is confirmed by EDX and XPS measurements. Addition of LiCl to APC/THF solution can not only enhance the gravimetric energy densities but also greatly improve the rate performance. The possible function mechanism is proposed and discussed.

Keywords: primary battery; magnesium anode; CF_x cathode; dual-salts electrolyte

1. Introduction

Although a great attention was paid on rechargeable batteries, particularly lithium ion batteries, in the last decade due to their evident superiority of reusability [1-3], primary batteries are still widely used to power various electronic devices for consumer industry, such as