

Development of Conversion-Type FeF₃ Cathode in Rechargeable Lithium Battery (2) Improving Effect of Electrolyte Solution on Cycle Performance of FeF₃ Cathode

Keitaro Matsui, Hiroshi Senoh, Toyoki Okumura, Masahiro Shikano,
Hikari Sakaebe and Hironori Kobayashi
*National Institute of Advanced Industrial Science and Technology (AIST),
1-8-31 Midorigaoka, Ikeda, Osaka 563-8577, Japan*

E-mail: h.senoh@aist.go.jp

For the development of high-energy battery, iron trifluoride (FeF₃) is one of the attractive cathode active materials because of low cost, environmentally benign, and its high theoretical capacity of 712 mAh g⁻¹ [1]. However, the charge-discharge cycle performance of FeF₃ is insufficient for practical use. Previously one of the authors reported the effect of the electrolyte additive (e.g. anion receptor) to improve the FeF₃ cycle performance [2]. In this study, we investigated the influence of the electrolyte solution on the cycle performance of FeF₃ to clarify the mechanisms of the cycle degradation.

FeF₃ cathode material and the evaluation cell (CR2032; Li anode) were prepared in the manner previously reported [2]. Two types of electrolyte solution were used here; 1.0 mol dm⁻³ LiPF₆ in EC/DMC (1/1 vol.), and in EC/PC (1/1 vol.) as solvents. Charge-discharge profiles of the FeF₃/Li cells were performed in the voltage 1.0-4.5 V at 25°C. Morphology of the FeF₃ cathode after cycles were observed by SEM (JEOL JSM-6700FV).

The FeF₃/Li cells with the EC/PC solvent showed excellent cycle performance compared to the cells with the EC/DMC solvent. SEM observations of the cathode after cycles revealed a formation of film on the FeF₃ surface, and its thickness in the 'EC/PC' cells was clearly thinner than that in the 'EC/DMC' cells. This finding suggests that the cycle performance of the FeF₃ cathode is adversely affected by the formation of the film on the FeF₃ surface. Thickness of these films could be reduced by optimizing the desirable solvent of the electrolyte solution.

Acknowledgment:

This work was financially supported by RISING2 project of NEDO, Japan.

References:

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