N,N-diethyl-trimethylsilylamine as an Electrolyte Additive for Enhancing Electrochemical Performance of High Voltage Spinel Cathode

Jiahui Chen^{1,2,3}, Fuxiao Liang¹, Hui Zhang¹, Jianhong Liu¹, Cuihua Li^{1,*}

¹ College of Chemistry and Environmental Engineering, Shenzhen University, Shenzhen 518060, China

² Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen 518055, China

³ Shenzhen College of Advanced Technology, University of Chinese Academy of Sciences, Shenzhen 518055, China

*E-mail: licuihuasz@163.com

doi: 10.20964/2017.08.25

Received: 3 May 2017 / Accepted: 31 May 2017 / Published: 12 July 2017

In this work, N,N-diethyl-trimethylsilylamine (EMSA) is used as an electrolyte additive for a 5 V-class high voltage $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ cathode. In presence of 0.5 wt.% EMSA, Li/ $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ cell exhibits an attractive cycling performance compared to the cell without EMSA, improving the discharge capacity retention from 76.1 % to 84.9% after 500 cycles at 1 C and 25 °C, and from 52.4% to 94.8% after 100 cycles at 0.5 C and 55 °C. ^{19}F nuclear magnetic resonance (^{19}F NMR), inductively coupled plasma atomic emission spectrometry (ICP-AES) and X-ray photoelectron spectroscopy (XPS) studies reveal that EMSA serves as a hydrofluoric acid scavenger to alleviate the dissolution of Mn and Ni ions from $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ cathode and the concurrent decomposition of electrolyte. As a result, the stability of the cathode/electrolyte interface and cycling performance of $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ are significantly improved. Moreover, the superior cycling performance of a Li/graphite cell with EMSA is also achieved because the surface film modified by EMSA allows facile charge transfer.

Keywords: Lithium ion battery, Electrolyte additive, N,N-diethyl-trimethylsilylamine, High voltage, Spinel $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$

[FULL TEXT](#)

© 2017 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).