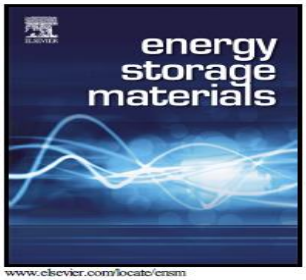
Variations on Li_3N protective coating using ex-situ and in-situ techniques for Li° in Sulphur Batteries

Marya Baloch, Devaraj Shanmukaraj, Oleksandr Bondarchuk, Emilie Bekaert, Teofilo Rojo, Michel Armand



www.elsevier.com/locate/ensm

PII: S2405-8297(17)30012-0
DOI: http://dx.doi.org/10.1016/j.ensm.2017.06.016
Reference: ENSM183

To appear in: *Energy Storage Materials*

Received date: 2 January 2017
Revised date: 15 June 2017
Accepted date: 22 June 2017

Cite this article as: Marya Baloch, Devaraj Shanmukaraj, Oleksandr Bondarchuk Emilie Bekaert, Teofilo Rojo and Michel Armand, Variations on Li 3N protectiv coating using ex-situ and in-situ techniques for Li° in Sulphur Batteries, *Energ Storage Materials,* http://dx.doi.org/10.1016/j.ensm.2017.06.016

Abstract

Lithium sulphur batteries are promising candidates for upcoming/future energy storage systems due to their theoretical specific energy (2500 Wh kg^{-1}). Poor cycle life and low capacity retention are main issues restraining their commercialization. To achieve high energy density, metallic lithium or concentrated alloy negatives are required wherein both the challenge of high reactivity leading to degradation, and safety issues have to be dealt with. $LiNO_3$ has been reported as an electrolyte additive to produce passivation layer on the metallic lithium anode. However, the passivation layer thickness cannot be controlled. In order to have similar passivation effect with controlled thickness and to avoid undesirable reaction on the surface of the lithium metal, Li_3N protective layers has been investigated. This study demonstrates the effect of coating techniques and feasibility of Li_3N protective layers for Li metal anodes in Li-S cells using just a standard sulphur/ carbon composite electrode, thereby independent from the effects of binders or any porous cathode architecture. A first approach to study the surface morphology of Li with Li_3N layers in Li-S batteries has been made. Improved cycling efficiency and good lithium plating/stripping characteristics were observed with a smooth surface morphology of Li metal. A viable in-situ approach of depositing Li_3N layer on the Li metal anode using ($[(CH_3)_3SiN_3]$) as electrolyte additive is proposed.

Keywords: Li_3N protective layers, Li-S batteries, In-situ Li_3N deposition, Li metal surface analysis, Energy storage