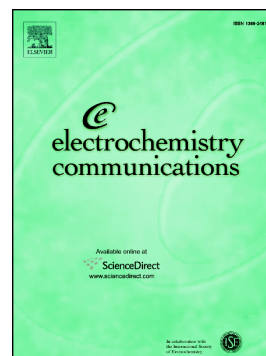


Accepted Manuscript

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PII: S1388-2481(17)30348-X

DOI: <https://doi.org/10.1016/j.elecom.2017.12.013>

Reference: ELECOM 6109

To appear in: *Electrochemistry Communications*

Received date: 27 November 2017

Accepted date: 11 December 2017

Please cite this article as: Ashish Rudola, Satyanarayana R. Gajjela, Palani Balaya , High energy density in-situ sodium plated battery with current collector foil as anode. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Elecom(2017), <https://doi.org/10.1016/j.elecom.2017.12.013>

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High Energy Density *In-situ* Sodium Plated Battery with Current Collector Foil as AnodeAshish Rudola,^{*,a,b} Satyanarayana R. Gajjela^a and Palani Balaya^{*,a}^a Department of Mechanical Engineering, National University of Singapore, 117576, Singapore^b Department of Materials Science and Engineering, National University of Singapore, 117575, Singapore

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Abstract

Viability of room-temperature rechargeable *in-situ* sodium plated batteries (INPBs) with bare Cu current collector foil as anode is reported which operated by sodium plating-stripping on Cu foil during each charge-discharge cycle, respectively. Using 1M NaBF₄ in tetraglyme electrolyte, an Na₂Fe₂(CN)₆//Cu INPB delivered 336 Wh/kg specific energy density with 76 % retention in 100 cycles.

Keywords

In-situ sodium plating, Anode-free, Current Collector Anode, Non-dendritic, NaBF₄ in Tetraglyme, Na₂Fe₂(CN)₆

1. Introduction

New concepts may be needed for sodium based batteries to be competitive with existing commercial lithium-ion batteries (LIBs) as current sodium-ion batteries (NIBs) cannot compete with LIBs in energy density.[1] One promising concept could be the *in-situ* metal plated battery (IMPB), first conclusively demonstrated by Neudecker *et al.* for lithium storage in a thin-film configuration.[2] In such *in-situ* lithium plated batteries (ILPBs), the anode is composed of only a current collector foil where repeated Li metal plating and stripping occurs *in-situ* during each charge and discharge cycle, respectively. The cathode functions in the same manner as it would in traditional LIBs and is composed of an appropriate Li containing “active material” (AM) layer coated on a current collector.[2] Due to elimination of the anode AM, an efficient IMPB is expected to be lighter, smaller and cheaper than a corresponding metal-ion battery for the same cathode and electrolyte, as illustrated in the Graphical Abstract. Following this initial report, Liu *et al.*[3] reported another thin-film ILPB and recently, Qian *et al.* demonstrated the first ILPB in a coin-cell configuration, a prerequisite for the commercial feasibility of ILPBs in various applications.[4]

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