

INK JET PRINTING AND PRINTABLE ELECTROLYTES FOR ALL-SOLID-STATE LITHIUM MICROBATTERIES

Pierre-Emmanuel Delannoy^a, Djamel Aidoud^a, Delphine Guy-Buissou^b, Benoit Riou^b,
Dominique Guyomard^a, Thierry Brousse^a, Jean Le Bideau^a, Bernard Lestriez^a

^a *Institut des Matériaux Jean Rouxel de Nantes (IMN)*

2 rue de la Houssinière B.P. 32229 44322 Nantes Cedex 3

^b *ST Microelectronics, 10 Rue Thales de Millet, 3700 Tours*

pierre-emmanuel.delannoy@cnsr-immn.fr

Lithium battery is very effective system to store electrical energy for many applications, in particular for on board application. A promising market [1] is developing for microbatteries because of many new devices requiring some energy on board with drastic size limitation: RFID ship, medical or cosmetic devices (pace maker or nicotine patch), autonomous sensors, security (smart credit card)...

This poster presents our microbatteries development in regard with literature. Standard way of deposition is based on PVD process and use LiPON [2,3] as solid electrolyte with dense electrodes. This commercialized solution induces high cost and long time process. Other interesting ways use new 3D design to increase microbattery performance, in terms of energy or power density, or use easier way of deposition like printing to reduce process costs.

Our approach uses ink jet printing to deposit electrode and electrolyte. First, aqueous based electrode ink, compatible with ink jet printing, has been formulated to obtain homogeneous porous composite LiFePO₄ electrode [4]. Furthermore, photo-ionogel solid electrolyte has been obtained through UV-curing route with printed ionic liquid and monomers precursors. After the photo-polymerization of the deposited precursors, ionic liquid and lithium salt are confined into a polymeric matrix to form the photo-ionogel solid electrolyte. This printed photo-ionogel is compatible with porous composite electrode and has high solid electrolyte performances: high ionic conductivity, high electrochemical stability versus lithium and high thermal stability. Full lithium metal microbatteries incorporating photo-ionogel electrolyte have been printed and electrochemically tested.

Reference to a journal publication:

[1] Thin-Film and Printed Battery Markets. NanoMarkets, (2012).

[2] J.B. Bates, N.J. Dudney, G.R. Gruzalski, R.A. Zuhr, A. Choudhury, C.F. Luck, Solid State Ionics, 53-56, (1992), 647-654.

[3] X. Yu, J.B. Bates, G.E. Jellison, F.X. Hart, J. Electrochem. Soc., 144(2), (1997), 524-532.

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