

A Solid State Thin Film Electrolyte for Microbattery Applications

Hee-Won Lee^a, Jeong-Kyu Lim^a, Seung-Joo Lee^b,
Hong-Koo Baik^b, Sung-Man Lee^a

^a Department of Advanced Material Science and Engineering, Kangwon National University, Chuncheon, Kangwondo, 200-701, South Korea

^b Department of Metallurgical Engineering, Yonsei University, Seoul, 120-749, South Korea

A thin film microbattery is very attractive as a micro power sources for many applications such as MEMS devices and various power implantable microdevices. Lithium-ion-conducting solid-state electrolyte film is the most essential among the thin-film components of the microbattery. Various kinds of solid-state electrolytes are developed for microbattery applications. Among them, amorphous thin films are quite suitable for the electrolyte of microbattery. This is due to their isotropic characteristics and absence of grain boundaries.

The amorphous lithium phosphorus oxynitride (LiPON) thin film has been used as a solid-state electrolyte, for the past several years [1]. In this electrolyte, incorporation of nitrogen into the Li_3PO_4 appears to change the distribution of the phosphate chains and form nitrogen cross-linked structure. It resulted in conductivity increase and improvement of the electrochemical stability.

It is known that the glass electrolytes containing two or more network formers show the improved electrical properties [2,3]. According to our recent study [4], in the nitrogen incorporated $\text{Li}_2\text{O-P}_2\text{O}_5\text{-SiO}_2$ electrolyte system, the ionic conductivity increases with the Si/P ratio.

In this study, we fabricate the Li-P-X-O(-N) (X= Si or B) glass thin film, and investigate the electrolyte properties for a microbattery application.

Acknowledgement

This work was supported by the Korean Ministry of Science and Technology through the research program for 'National Research Laboratory'

References

- [1] J.B. Bates, N.J. Dudney, G.R. Gruzalski, R.A. Zuhr, A. Choudhury, C.F. Luck and J.D. Robertson, *J. Power Sources* 43-44 (1993) 103
- [2] K. Miyauchi, T. Oi and T. Suganuma, US Pat. No. 4390460, June 28, (1983)
- [3] J.B. Bates, N.J. Dudney, G.R. Gruzalski, R.A. Zuhr, A. Choudhury, C.F. Luck, and J.D. Robertson, *Solid State Ionics* 53-56 (1992) 647
- [4] S.J. Lee, H.W. Lee, J.K. Lim, Y.L. Kim, H.K. Baik, S.M. Lee, in Abstract 697 of the Meeting of the Electrochemical Society, Salt Lake City, Utah (Oct. 20-24, 2002)