Electrochemical Characteristics of Novel Polymer Electrolyte Functioning of Anode Protection Layer and Bulk Electrolyte Film Simultaneously for Lithium Metal Polymer Batteries

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Worldwide research and developmental efforts are currently underway to fabricate lithium metal polymer batteries(LMPB) using lithium(Li) metal as anode and polymer electrolyte as its electrolyte, respectively[1,2]. Potential fields of application for LMPB range from small portable electronic device and personal communication equipment such as IMT-2000 or next generation PDA to electric vehicles(EV) due to a potential advantage of high energy density.

However, since Li metal is very corrosive and highly reactive toward electrolytes and impurities such as residual solvents, humid air, and even in oxygen atmosphere, a non-uniform and thick passive layer is easily formed on the electrode surface[3]. In addition, since the charge/ discharge reactions of Li metal correspond to the electrochemical deposition/dissolution of Li^+, undesirable morphologies of Li anode such as dendrite and dead Li can be seriously formed on the Li anode surface[4,5]. Among them, the dendrite formation and growth crucially affect the safety and cycle performance of LMPB.

In this study, we have introduced a dense and thin adhesive layer having ion conducting character on one side of porous membrane through a coating process. The porous membrane made it possible to enhance mechanical property of the polymer electrolytes. The dense layer could effectively inhibit the Li dendrite growth through the large pores of the membrane under charging process.

The asymmetrically coated membrane was laminated with Li anode as a physical protection layer through the lamination process. The laminated coated membrane has efficiently protected Li anode from corrosion and side reaction.

The various electrochemical characteristics of the polymer electrolyte have been investigated including ionic conductivity. The interfacial behavior of the polymer electrolytes with the Li anode was investigated. The morphological characteristics of the polymer electrolytes and Li anode surface have been studied with repeated cycle. Suppression of dendrite growth and dead Li is expected to enhance the long-term stability of LMPB in the charge/ discharge behavior.

References

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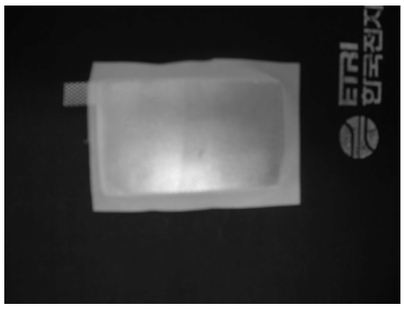

Fig. 1. The Li anode laminated with asymmetrically coated membrane as an anode protection layer and bulk polymer electrolyte(Ni-mesh current collector, coated membrane thickness: 30μm, electrode size: 3×5 cm^2).