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Gel Polymer Electrolytes Based on Poly(ethylene-co-methyl acrylate) for Lithium-Ion Polymer Batteries

폴리에틸렌계 공중합체를 이용한
리튬이온폴리머전지용 겔 고분자 전해질

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In recent years, there has been an increasing need for high energy density rechargeable batteries for portable electronic equipments. Among them, lithium(lithium-ion or lithium metal) polymer batteries are now being widely studied and developed, because they can be produced in a variety of forms, thus permitting portable batteries of the required shapes to be produced readily, and enabling customization of portable power driven electronic equipment to be produced. In this respect, most of recent research works have been directed to the preparation and characterization of gel polymer electrolytes that exhibit higher ionic conductivity at ambient temperature. Gel polymer electrolytes are prepared by incorporating liquid electrolytes into a matrix polymer. Among them, there are some gel polymer electrolytes which exhibit ionic conductivity in excess of 10^3 S/cm, but the mechanical properties of the material are not enough to produce thin films, because the impregnation of liquid electrolyte into a polar polymer resulted in softening of the polymer.

In this work, we tried to investigate the electrical properties of gel polymer electrolytes based on poly(ethylene-co-methyl acrylate) copolymer as a matrix polymer. In the copolymer, ethylene unit is a highly crystalline and non-polar phase, and methyl acrylate unit is an amorphous and polar phase. Thus, liquid electrolyte is contained in the amorphous and polar phase to form the ion conductive channels, and the crystalline and non-polar phase forms a supporting structural phase. We attempted to fabricate lithium-ion polymer cells composed of a mesophase carbon fiber(MCF) anode, poly(ethylene-co-methyl acrylate)-based gel polymer electrolyte, and lithium-cobalt oxide cathode. The characteristics and electrochemical performance of these lithium-ion polymer cells will be presented and discussed.