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Electrochemical Properties of Solid Polymer Electrolyte Based on Segmented Polyether Polyurethane Containing Multivalent Salt

다가 염을 함유한 세그멘트 폴리우레탄으로 구성된 고체 고분자 전해질의 전기화학적 물성

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Segmented polyether polyurethane (SPEU) has the general structure $(A-B)_x$, where A is a polyurethane segment (hard segment) and B is a polyether segment (soft segment). The hard segment contributes to good mechanical properties. Also, the high mobility of soft segment, due to low transition temperature (Tg), contributes to the higher ionic conductivity. However, SPEU includes a fatal disadvantages that is poor electrochemical stability. The poor electrochemical stability results from interaction between the single ion such as Li^+ and urethane group.

In this study, we improved electrochemical stability by using the multivalent salts such as Mg^{2+} in SPEU, because multivalent salts have good electrochemical stability in SPE. This SPEU is prepared from 4,4'-methylenebis(phenyl isocyanate), polyethylene glycol, and 1,4-butanediol. Solid polymer electrolytes (SPEs) based on SPEU and lithium or magnesium perchlorate [$LiClO_4$ or $Mg(ClO_4)_2$] were prepared. By analyzing the fourier-transform infrared (FT-IR) spectrum of the solid polymer electrolyte, it was confirmed that the interaction of magnesium ion to the oxygen of polyether chain was stronger than that of lithium ion. The highest ionic conductivities of 1.5×10^{-5} S/cm and 4.5×10^{-6}S/cm were obtained at room temperature for polymeric films containing $LiClO_4$ and $Mg(ClO_4)_2$, respectively. Results of cyclic voltammetry (CV) showed that SPE consisting of SPEU and magnesium salt has good electrochemical stability up to the working voltage of 1.9 V at $[O]/[Mg^{2+}]$ = 50.