

NASICON-Type lithium stable Lithium-ion Conducting electrolytes
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High lithium-ion conducting solid electrolytes of the substituted NASICON-type $\text{LiTi}_2(\text{PO}_4)_3$ are attractive for the electrolyte in all solid state batteries as well as the separator in aqueous lithium-air batteries because of their high lithium-ion conductivity and stability in aqueous solutions. However, the Ti^{4+} -containing NASICON-type solid lithium-ion conductor is unstable in contact with a lithium metal. Here, we have developed a lithium-stable high lithium-ion conducting NASICON-type solid electrolyte of $\text{Li}_{1.4}\text{Al}_{0.4}\text{Ge}_{0.2}\text{Ti}_{1.6}(\text{PO}_4)_3$ (LAGTP) [1] by protecting the surface with a polyethylene oxide (PEO) based polymer electrolyte. The surface of a tape cast LAGTP film was coated with a $[\text{PEO}_{18}\text{Li}(\text{CF}_3\text{SO}_2)_2\text{N}(\text{LiTFSI})\text{-1.44 N-methyl-N-propylpiperidinium(PP13)-TFSI}]$ with 10wt% nano- SiO_2 composite polymer electrolyte [2].

A solution of PEO in acetonitrile with LiTFSI, PP13-TFSI and well dispersed nano- SiO_2 particles was dropped on surfaces of the LAGTP films. The LAGTP film (around 0.2 mm in thickness) was prepared by a tape casting method. The stability of the surface coated LAGTP film with lithium metal was confirmed by the impedance change with time of the Li/LAGTP/Li cell.

Figure 1 (a) shows the time dependence of the impedance for the Li/10 wt,% $[(\text{PEO}_{18}\text{LiTFSI}\text{-1.44PP13})\text{-10 wt,\%SiO}_2]\text{-LAGTP/Li}$ cells at 60 °C. The diameter of the large semicircle is associated with the overall interface resistance between Li and the coated LAGTP. The interface resistance decreased slightly after 14 days, which is compared with our previous result for those of the Li/LAGTP/Li cell [3].

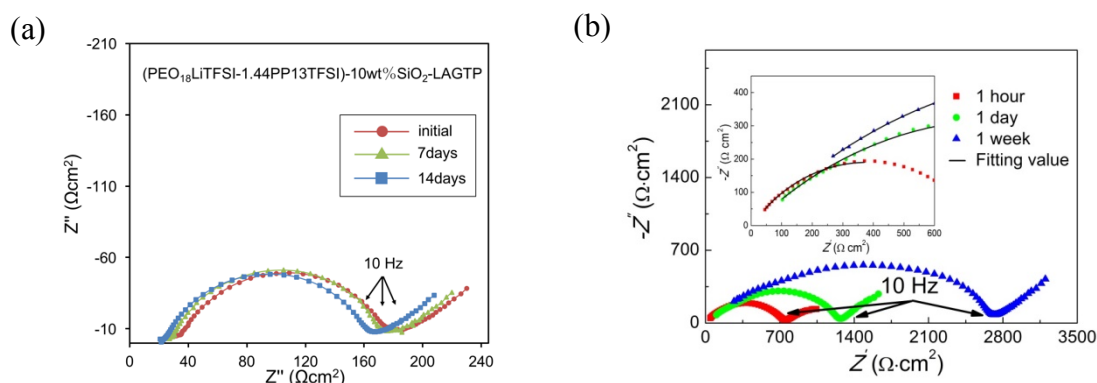


Fig. 1 Impedance profiles for (a) Li/10 wt,% $[(\text{PEO}_{18}\text{LiTFSI}\text{-1.44PP13})\text{-10wt\%SiO}_2]\text{-LAGTP/Li}$ at 60 °C and (b) Li/LAGTP/Li at 25 °C

References:

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