

## Electrical and Thermal Properties of the Gel Polymer Electrolytes based on Morpholinium Ionic Liquids

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Ionic liquids, defined as salts with melting temperatures below 100 °C, evolved from traditional high temperature molten salts. Specially, Morpholinium-based ionic liquids have high ionic conductivity, high thermal stability, wide electrochemical window, and wide liquidity rang. But from mechanical and fabrication standpoint, solid state is preferred to liquid state in secondary lithium battery. In this work, N-ethyl-N-methylmorpholinium bistrifluoromethanesulfonimide(Mor<sub>12</sub>TFSI) was synthesized and gel polymer electrolyte based on these ionic liquids was prepared. The propylene carbonate (PC) was added to confirm how to affect the ionic conductivity and morphology in poly(vinylidene fluoride)-hexafluoropropylene [PVdF(HFP)] polymer matrix. The gel polymer electrolyte Mor<sub>12</sub>TFSI-PVDF (HFP)(2:1)-PC(21wt%) showed very high ionic conductivity 10<sup>-2</sup> S/cm. The gel polymer electrolytes without propylene carbonate showed 10<sup>-3</sup> S/cm. The gel polymer electrolytes without PC can be used as solid state electrolyte until 400 °C and those of containing PC only can be used until 60 °C.