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Highly Conductive, Stretchable, and Transparent Solid Polymer Electrolyte Membrane[1] RUIXUAN HE, University of Akron, MAURICIO ECHEVERRI, Kent Displays, THEIN KYU, University of Akron — With the guidance of ternary phase diagrams, completely amorphous polymer electrolyte membranes (PEM) were successfully prepared by melt processing for lithium-ion battery. The PEM under consideration consisted of poly (ethylene glycol diacrylate) (PEGDA), succinonitrile (SCN) and Lithium bis(trifluoro-methane)sulfonamide (LiTFSI). After UV-crosslinking, the PEM is transparent and light-weight. Addition of SCN plastic crystal affords not only dissociation of the lithium salt, but also plasticization to the crosslinked PEGDA network. Of particular importance is the achievement of room-temperature ionic conductivity of $\sim 10^{-3}$ S/cm, which is comparable to that of commercial liquid electrolyte. Higher ionic conductivities were achieved at elevated temperatures or with use of a moderately higher molecular weight of PEGDA. In terms of electrochemical and chemical stability, the PEM exhibited oxidative stability up to 5 V against lithium reference electrode. Stable interface behavior between the PEM and lithium electrode is also seen with ageing time. In the tensile tests, samples containing low molecular weight PEGDA are stiffer, whereas the high molecular weight PEGDA is stretchable up to 80% elongation.

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