

Improved interfacial properties of the lithium / PEO solid polymer electrolyte interface

Solid polymer electrolytes to be used in lithium batteries are required to have high ionic conductivity, fair dimensional stability and material compatibility with electrodes. From the point of view of commercial applications, modification of the electrolytes by the addition of suitable plasticizers to complex electrolytes is a simple method. In this work, a new plasticizer, poly(perfluoro ethyl methyl oxide) (PPFEMO) was chosen, as an additive to the PEO-LiN(CF₃ SO₂)₂ or PEO-LiTFSI complex electrolyte because of the compatibility of the PPFEMO with the electrolyte. The effects of the plasticizer were examined using thermal, dielectric and ionic conductivity measurements.

While the compatibility of the PEO-LiX electrolytes with cathode materials has been ascertained, there is still a major concern about the reactivity of these electrolytes with the lithium metal anode. The time evolution of the lithium interfacial resistance in an unplasticized PEO-LiTFSI and in plasticized PEO-LiTFSI-PPFEMO electrolyte was performed and the data were obtained by monitoring the impedance response of symmetrical Li/polymer electrolyte /Li cells maintained under open circuit conditions at 60 °C. The results clearly show that, while in the cell with unplasticized electrolyte, the interfacial resistance progressively increases with time, in the PPFEMO-plasticized electrolyte the interfacial resistance does not vary considerably over a prolonged period of time. Even though the initial passivation rate is somewhat high, after several hours, PPFEMO added electrolyte appears to prevent further corrosion of the electrodes. This indeed, is a very important finding concerning the protection of the lithium anode in a rechargeable battery. These results further conclude that PPFEMO is really an interesting material to be used as a novel plasticizer, in solid polymer electrolytes, due to its role in enhancing the ionic conductivity, as well as in reducing the lithium/electrolyte interfacial resistance.