Electrochemical Properties of Polymeric Composite Electrolytes Containing Oriented Clay Materials

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Recently, polymer lithium batteries are being actively developed by many research groups, and they are in constant search of a novel polymer electrolyte, High specific energy and power, safe operation, flexibility in packaging, and low cost of processing are the characteristics sought in a polymer electrolyte for uses in lithium batteries. In this work, the polymeric electrolyte composites (PECs) based on poly(ethylene oxide) (PEO), ethylene carbonate (EC) as a plasticizer, and lithium montmorillonite (Li-MMT) clay were fabricated, and investigated for understanding the effects of Li-MMT/EC in the polymer matrix on the ionic conductivity. For a lithium battery application, the native sodium cations in MMT were exchanged for lithium cations. As a result, the lithium ion was intercalated into the layer of the MMT clay, and thus PEO entered the galleries of MMT clay. The ionic conductivity was enhanced with increasing MMT contents due to the immobile MMT clay serving as the anion species and the decreased crystallinity of PEO. The effect of clay orientation on the ion conducting behaviors and the structural properties were also discussed.