Battery Performance using Solid Polymer Electrolyte having Hyper-Branched Structure

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Introduction

The properties of the electrolyte, especially its high ionic conductivity and low interfacial resistance, are the important issue to reach high performance battery.

In the lithium secondary battery system, the solid polymer electrolytes have been widely tested.

Generally, the solid polymer electrolyte shows low ionic conductivity at lower temperature region. Thus the lithium secondary battery using solid polymer electrolyte works in the temperature region above 60 °C.

To realize the higher ionic conductivity especially in low temperature region, we synthesized new macromonomer having hyper-branched structure. After cross-linking this macromonomer, we obtained solid polymer electrolyte having hyper-branched structure. This new macromonomer showed a lower viscosity at ambient temperature. And the solid polymer electrolyte obtained by cross-linking this macromonomer showed a higher ionic conductivity even at 40 °C.

From the above result, higher battery performance was expected by using the new hyper-branched solid polymer electrolyte.

The performance of the battery consist of Li/hyper-branched solid electrolyte/$LiCoO_2$ system was examined.

Experimental

The cathode was obtained by coating ink composed of $LiCoO_2$, PVDF, and carbon on aluminum foil. The dried cathode was dipped into a precursor solution consisting of hyper-branched macromonomer, LiTFSI and initiator, and then cross-linked. The electrolyte was formed on the cathode by coating the same precursor liquid and cross-linking. Lithium foil was used as an anode.

Result

The obtained cell showed the good temperature performance even at 40 °C as shown in Figure 1. The capacity at 40 °C was similar to that at 60 °C, and cathode utilization was c.a. 95 %. Also the cell showed good rate capability. The capacity at 1 C was 90 mAh/g for $LiCoO_2$ cathode.

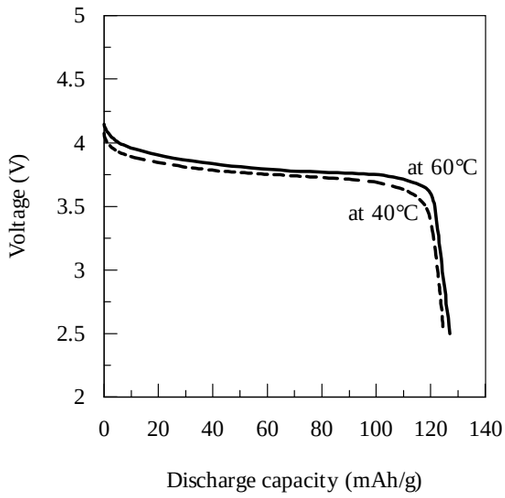

Figure-1. Temperature dependence of discharge capacity for the cell consisting of Li/Solid-Electrolyte/$LiCoO_2$ using cross-linked hyper-branched macromonomer as solid polymer electrolyte.
LiTFSI ([Li]/[O]=0.04) at 0.2C discharge rate.