Initiator Effect on the Performance of the Lithium Ion Polymer Batteries based on the Polymer Electrolytes prepared by Free Radical Polymerization

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Introduction

The rapid progress and widespread use of portable electronic devices have increased the demand for lithium-ion batteries, because they are light and offer high voltage and high energy density. Also, as electronic devices continue to become smaller, thinner and more flexible, thin type batteries are urgently needed.[1-3] In order to develop thin-type batteries with a soft, laminated case, a number of gel-type polymer materials and electrolyte compositions were investigated.[4-7]

We developed the lithium ion polymer batteries(LIPB) based on the polymer electrolytes prepared by free radical polymerization. In many studies, the polymer electrolytes have been prepared by the free radical polymerization since the polymer electrolyte films are easily formed by this free radical polymerization method. However, the effect of initiator, which is main component for polymerization of pre-solution, on the LIPB performance hardly have been reported.

In this work, the effect of initiator on the electrochemical characteristics of the LIPB based on the polymer electrolytes prepared by free radical polymerization was investigated.

Experimental

Appropriate amount of crosslinkable monomer, the liquid electrolyte, and an initiator were mixed until it became a homogeneous solution. The resulting solution was cast onto a Teflon plate and then was heated at 80^{o}C for 2 hrs for polymerization to make a film of the crosslinked polymer electrolyte. The battery characteristics and performance were investigated by impedance spectroscopy, cyclic voltammetry, and charge -discharge cycling curves.

Result and Discussions

To investigate the effect of the initiator on the electrochemical characteristics of the LIPB, the discharge capacities of the LIPB which was composed of carbon anode, polymer electrolyte, and $LiCoO_2$ cathode were measured as a function of initiator content. A plot of the discharge capacities at –20^{o}C as a function of initiator content for LIPB is shown in Fig.1. The discharge capacities increased as the initiator content increased up, and then it leveled off when the content increased further.

And also it was observed that the electrochemical reaction rate of LIPB increased as the initiator content increased. Therefore, it is expected that the increase in the electrochemical reaction rate of LIPB is principle reason for the enhancement in the discharge capacity at higher initiator content.

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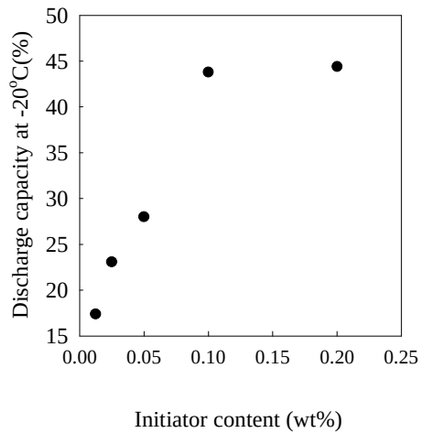

Fig. 1. The discharge capacities of the LIPB as a function of initiator content at –20^{o}C