

Gel Polymer Electrolyte Comprising Polyurethane-Poly(ethylene oxide) Multi-block Copolymer Network for Lithium Ion Batteries

Seung Sik Hwang, Jae-man Choi, Seok-Kwang Doo

Energy Lab, Samsung Advanced Institute of Technology,
Samsung Electronics Co., Ltd.
97, Samsung2-ro, Giheung-gu, Yongin-si, Gyeonggi-do,
Korea

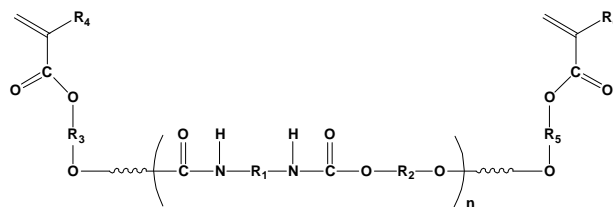


Figure 1. Structure of polyurethane di(meth)acrylate.

Polymer electrolyte for Lithium ion batteries have gained much attention as a potential power source for mobile electronic devices as well as electric vehicles due to their several advantages such as improved safety and reliability, compared to those with liquid electrolytes.

Macro azo initiator (MAI) is a unique azo bis compound, which gives block polymer by polymerizing with radical polymeric vinyl monomer. MAI has repeated structural sequences of polymer segment and azo group and its molecule has several radical-generating sites. For this reason, MAI can be designed to produce polymer with high effect of blocked state. The MAIs containing poly(ethylene oxide) unit are easily introduced the PEO segment in the polymer chain. The PEO unit in the polymer matrix gives help to enhance the solubility and conducting path of Li^+ ion.

We have developed lithium ion conducting gel polymer electrolytes prepared by co-polymerization of polyurethane diacrylate and macro azo initiator containing poly(ethylene oxide) unit. The structure of resultant polymer is polyurethane-PEO multi-block copolymer type network. The ionic conductivities of the resulting gel polymer electrolyte are on the order of magnitude of $10^{-3} \text{ S cm}^{-1}$ at 303 K, which is similar to typical gel polymer electrolyte.

Lithium ion polymer cells composed of LiCoO_2 and graphite electrode with the gel polymer electrolyte show stable charge and discharge reaction over 100 cycles. The resulting gel polymer electrolyte showed promising electrochemical properties including ionic conductivity, wide range in working potential and stable cycle performance as a lithium ion conducting medium for lithium ion batteries.

References

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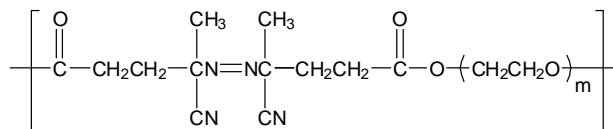


Figure 2. Structure of macro azo initiator containing poly(ethylene oxide) unit.

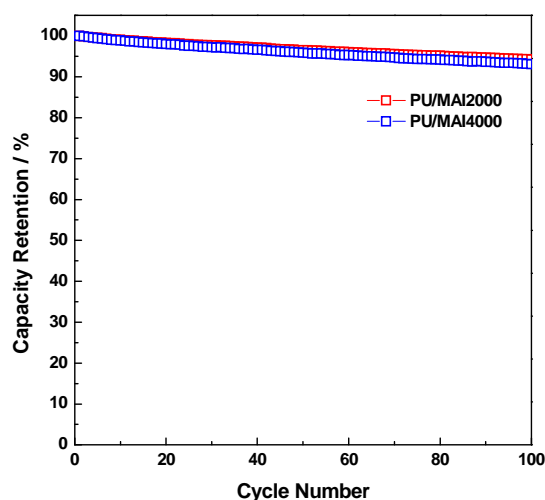


Figure 3. Cycle performance of $\text{LiCoO}_2/\text{Graphite}$ full cell using gel polymer electrolyte of polyurethane-poly(ethylene oxide) multi-block copolymer network.