ABSTRACT

Polymer Electrolyte Membrane Of Chitosan Nanoparticle Based On Lithium Salt ($LiCF_3SO_3$)

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Polymer electrolyte membrane is a polymer solid matrix containing alkali metal salts and has the ability to conduct electrical current through the movement of ions in the secondary battery. Polymer electrolyte membranes was developed because it has the advantage of high mechanical strength, high chemical stability, high conductivity, and they are also easily made in thin sizes and have a stable temperature, dimensions or size. Fabrication of membrane using the chitosan which is doped with Lithium salts ($LiCF_3SO_3$). Chitosan is used because it is environmentally friendly and polyelectrolytes containing the amine and hydroxyl groups as an anion transport molecules in the solution. The chitosan is also easily degraded, biocompatible, non-toxic and hygroscopically, can increase the conductivity, which have a high temperature and capacitance stability.

This study is aimed at the synthesis and testing of chitosan solid electrolyte polymer membranes based on lithium salts to increase the conductivity of secondary batteries. Synthesis of the chitosan nanoparticle that is aimed to obtain the nano-sized chitosan using HEM (High Energy Milling) with time variations of 60, 120, 180, 240, 300 and 360 minutes in which marked by CH60, CH120, CH180, CH240, CH300 and CH360 with 1500 rpm. To get real result, then the SEM, TEM, FTIR, XRD and EIS tests were performed. From the testing that has been done, the optimum milling time is 120 minutes conducted, because the optimum conductivity is 3.37×10^{-8} S/cm and 8,5 nm.

The agglomeration reducing and the conductivity increasing in polymer electrolyte membrane of the chitosan when it is added by PEO and $LiCF_3SO_3$. Addition of PEO and LiCF2SO3 could reduce a pace of ion transport diffusinon, then it could minimize resistance. The concentration of PEO was relatively constant and $LiCF_3SO_3$ varied from 10%, 30% and 50% of the total mass. Then the SEM, FTIR, XRD and EIS tests were performed. From the EIS test results, the optimum conductivity value is chitosan/$LiCF_3SO_3$ 10% membrane of 2.1×10^{-3} S/cm. The results of the analysis showed that at a concentration of $LiCF_3SO_3$ 10%, occurs a transport of Li^+ ions which served to increase the ionic conductivity of the polymer electrolyte membrane. Thus,

the amorphous phase structure is an effective medium for the transport of Li^+ ions. Because in this phase the free volume fraction, that is not occupied by the polymer molecules, is getting bigger. However, the conductivity will decrease if the concentration of $LiCF_3SO_3$ increases. This is due to the free volume fraction which is not occupied by the Li^+ ion decreases.

Key words : membrane, polymer, electrolyte, chitosan, $LiCF_3SO_3$