Thermal and electrical properties of PEO_9LiTf + *x* wt% TiO_2 + (15 – *x*) wt% Al_2O_3 nano-composite polymer electrolyte membranes

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Nano-composite polymer electrolytes are receiving attention as potential candidates to be used as electrolyte membranes in Lithium polymer batteries and other devices. However, a survey of literature reveals that, a systematic study on the effect of a mixture of two ceramic fillers incorporated in PEO_9 LiTf polymer electrolyte is lacking. In this work, we have studied thermal and electrical properties of the nano-composite polymer electrolyte PEO_9 LiTf + ***x*** wt% TiO_2 + (15 – ***x***) wt% Al_2O_3 (***x*** = 0, 2.5, 5, 7.5, 10, 12.5, 15) incorporating TiO_2 of grain size 200 nm and Al_2O_3 of grain size 150 mesh (pore size 5.8 nm). The electrolyte incorporating the mixture (10 wt% TiO_2 + 5 wt% Al_2O_3) showed higher conductivities compared to the one with 15 wt% Al_2O_3 at temperatures above 27 ^{0} C. Maximum enhancement in conductivity was obtained with 15 wt% TiO_2 addition. The observed conductivity enhancement has been attributed to Lewis acid-base type surface interactions of ionic species with O/ OH groups on the filler surface. However, all other electrolyte samples with mixed- fillers showed lower conductivities than the one incorporating 15 wt% Al_2O_3. Some samples with different mixed filler compositions even exhibited a drop in conductivity below that of the filler free electrolyte possibly due to the blocking effect.

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