INFLUENCE OF LITHIUM BIS(TRIFLUOROMETHANESULFONYL)IMIDE (LITFSI) INCORPORATION ON THE MECHANICAL STRENGTH AND SURFACE MORPHOLOGY OF PMMA-DES ELECTROLYTE FILMS

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This final Year Project Report entitled "**Influence of Lithium Bis(trifluoromethanesulfonyl)imide (LiTFSI) Incorporation on The Mechanical Strength and Surface Morphology of PMMA-DES Electrolyte Film**" was submitted by Nurin Afiqah Binti Mohd Azli in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Physics, in the Faculty of Applied Sciences, and was approved by

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ABSTRACT

INFLUENCE OF LITHIUM BIS(TRIFLUOROMETHANESULFONYL)IMIDE (LITFSI) INCORPORATION ON THE MECHANICAL STRENGTH AND SURFACE MORPHOLOGY OF PMMA-DES ELECTROLYTE FILMS

With the great scope of applications, solid polymer electrolytes (SPEs), due to their lightweight and highly flexible nature compared to liquid electrolytes, have attained tremendous attraction in energy storage system, mainly in lithium-ion batteries. Despite the promising potential, SPE films issue such as poor ionic pathway and unstable surface morphology limiting their performance. The poly methyl methacrylate (PMMA)-based polymer electrolyte has been chosen as it shows great feasibility due to excellent mechanical stability and high processability. This research aims to characterize the mechanical strength and morphology properties of PMMA by the addition of lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) and the use of a choline chloride: 1,3- propanediol-based deep eutectic solvent (DES) as an additive. This research was focusing on the changes in structure of PMMA caused by variations in LiTFSI concentration that affect the mechanical strength and stability of the polymer electrolyte for potential solid-state applications, which is critical in the continued development of solid-state battery technology. PMMA-LiTFSI-DES thin films were prepared through solution casting and characterized by using tensile test and Optical Microscopy (OM) analysis. The result of tensile testing showed that $PMMA10_{DES}$ had the highest tensile strength, which is 6.3 MPa and Young's modulus with a value 4513 MPa. Optical microscopy revealed the PMMA-DES was observed with a heterogeneous microstructure characterized by dispersed spherical domains meanwhile upon the addition of 10 wt.% of LiTFSI, this composition produced the better uniform and homogeneous microstructure, with minimal phase separation and finer dispersion of salt domains. The correlation of these results demonstrates that incorporating DES additive and a small amount of LiTFSI would improve the morphology of PMMA without reducing tensile characteristics. In conclusion, these findings provide valuable information to develop a solid polymer electrolyte that is structurally robust and morphologically stable for the next generation of energy storage systems.