

**STRUCTURAL AND IONIC CONDUCTIVITY STUDIES OF PMMA-BASED
SOLID POLYMER ELECTROLYTES DOPED WITH LITHIUM
BIS(TRIFLUOROMETHANESULFONYL)IMIDE (LITFSI) AND DEEP
EUTECTIC SOLVENT ADDITIVES**

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This Final Year Project Report entitled “**Structural and Ionic Conductivity of PMMA-based Solid Polymer Electrolytes Doped with Lithium Bis(trifluoromethanesulfonyl)imide (LiTFSI) and Deep Eutectic Solvent Additives**” was submitted by Nurul Hanis Syamimi binti Abdul Fattah 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

STRUCTURAL AND IONIC CONDUCTIVITY STUDIES OF PMMA-BASED SOLID POLYMER ELECTROLYTES DOPED WITH LITHIUM BIS(TRIFLUOROMETHANESULFONYL)IMIDE (LiTFSI) AND DEEP EUTECTIC SOLVENT ADDITIVES

Solid polymer electrolytes (SPEs) have gained increasing attention as promising alternatives to conventional liquid electrolytes due to their flexibility, safety, and ease of processing. Their greatest weakness, however, is low ionic conductivity at room temperature, and this hinders their use in high-performance lithium-based batteries. To overcome this, recent work lies in the improvement of ion transport through the modification of the polymer matrix and the addition of conductive fillers. The present research is devoted to the study of the structural and ionic conductivity characteristics of poly(methyl methacrylate) (PMMA)-based SPEs doped with lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) and reinforced with deep eutectic solvent (DES) using solution casting method. The DES, which is a mixture of choline chloride and propanediol in a (1:3 molar ratio) is used as an ionic additive to facilitate salt dissociation and enhance electrolyte performance. The study investigates the influence of various LiTFSI doping levels, including 10 wt.%, 30 wt.%, and 50 wt.%, on the structural and conductivity properties of the PMMA-DES-LiTFSI system. Functional group interactions were analyzed through Fourier Transform Infrared Spectroscopy (FTIR), and Ionic conductivity was determined by Electrochemical Impedance Spectroscopy (EIS). Based on a FTIR analysis, the carbonyl (C=O), sulfonyl (C–SO₂–N) and (CO–CH₃) regions had a significant shift of peaks, which means that there were strong molecular interactions between PMMA, LiTFSI and DES. The sample PMMA-DES-LiTFSI(10) showed the maximum peak intensity of 98.99%, which reflects the strong absorbance of functional groups and indicates better interaction within the polymer matrix. EIS data demonstrated a rise in the room-temperature ionic conductivity between $1.61 \times 10^{-8} \text{ Scm}^{-1}$ (without LiTFSI) to $1.76 \times 10^{-6} \text{ Scm}^{-1}$ at 10 wt.% LiTFSI. Upon the further addition of salt, the value of ionic conductivity dropped for 30 wt.% is $3.22 \times 10^{-8} \text{ Scm}^{-1}$ and 50 wt.% is $1.22 \times 10^{-8} \text{ Scm}^{-1}$. This might be due to ion aggregation between ions. Conclusively, the introduction of DES and LiTFSI content optimization has a great structural and electrochemical impact on PMMA-based SPEs, indicating its application in the next-generation lithium batteries.