

**INFLUENCE OF LITHIUM BIS(TRIFLUOROMETHANESULFONYL)IMIDE
ON THE ELECTRICAL, STRUCTURAL AND MORPHOLOGICAL
PROPERTIES OF METHYLCELLULOSE-BASED GEL POLYMER
ELECTROLYTE**

NURAMIRAH SYAFIKAH MOHD SOFFIAN

**BACHELOR OF SCIENCE (HONS.) PHYSICS
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA**

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NURAMIRAH SYAFIKAH BINTI MOHD SOFFIAN

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ABSTRACT

INFLUENCE OF LITHIUM BIS(TRIFLUOROMETHANESULFONYL)IMIDE ON THE ELECTRICAL, STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF METHYLCELLULOSE-BASED GEL POLYMER ELECTROLYTE

Most energy storage devices use an unsustainable and high-cost liquid solvent-based electrolyte system which poses a safety risk due to leakage, flammability, and poor thermal stability, limiting the long-term performance of devices. Polymer electrolyte is a great alternative to overcome the safety and sustainable concern, but most of them exhibit a low ionic conductivity due to the incompatibility between the polymer matrix. Therefore, this research focus was on the enhancement of ionic conductivity by formulating an optimized composition of gel polymer electrolyte. This alternative was achieved by utilizing polymer from a sustainable resource, specifically methyl cellulose (MC), which prepared by using dimethyl sulfoxide (DMSO) to dissolve the polymer, along with various concentrations of Lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) as the salt, under a continuous stirring at 70 °C until a homogeneous solution was obtained. The modified solution casting technique was used to undergoes gelation, allowing it to form a gel without being cast onto a substrate. The characterization of the gel polymer electrolyte was done by utilizing the electrochemical impedance spectroscopy (EIS). Fourier transform infrared spectroscopy (FTIR), and optical microscopy (OM). The ionic conductivity increased from $1.12 \times 10^{-4} \text{ S}\cdot\text{cm}^{-1}$ with the absence of LiTFSI to $4.00 \times 10^{-3} \text{ S}\cdot\text{cm}^{-1}$ with the addition of 40 wt.% of LiTFSI. The incorporation of more salt at 50 wt.% exhibit a drastic decrease on the ionic conductivity of $1.21 \times 10^{-3} \text{ S}\cdot\text{cm}^{-1}$ cause by the overload of salt resulting in salt aggregation. The highest ionic conductivity result is supported with the strong interaction between methylcellulose and LiTFSI from the FTIR spectroscopy analysis with the formation of new peak of SO_2 and CF_3 . The morphological of the sample also supported the result as the incorporation of 40 wt.% LiTFSI salt show a homogeneous and amorphous morphology while above the it shows bulk structures on the surface. This conclude that, incorporating the optimal amount of salt significantly enhances the ionic conductivity together with the structural and morphological evidence of the polymer electrolyte, which is highly suitable for the application in the batteries.

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