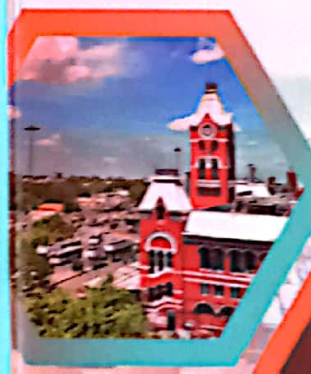

18th ASIAN CONFERENCE ON SOLID STATE IONICS

ACSSI - 2024

19th - 22nd FEBRUARY, 2024

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(Autonomous)
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BOOK OF ABSTRACTS

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C1-OP02

Development of PVDF Polymer-based Gel Polymer Electrolyte for Lithium-Ion Batteries

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Abstract

Lithium-ion batteries play a crucial role in modern technology due to their high energy density and rechargeable nature. The primary role of the electrolyte in Li-ion battery is to facilitate the movement of lithium ions between the anode and cathode, serving as a conductive medium. Gel electrolytes, with higher viscosity, enhance safety and flexibility for various applications, contributing to the evolving landscape of lithium-ion battery technology.

This study focuses on a specific composition consisting of Polyvinylidenefluoride (PVDF) as the polymer, ethylene carbonate (EC) and dimethyl carbonate as plasticizers, and $LiClO_4$ as the salt. The significance of each component in this formulation is examined for its impact on the electrolyte performance. First, the effect of incorporating Li ions into the PVDF-based gel electrolyte on ionic conductivity was studied by adding different Li salt amounts as weight ratios to polymer weight. The gel polymer electrolyte without Li ions showed a conductivity of $3.00 \times 10^{-5} S\,cm^{-1}$ at room temperature. Among the ratios (02, 0.4, 0.6, 0.8), 0.2 Li ion weight ratio showed the best performance value in conductivity with $6.86 \times 10^{-3} S\,cm^{-1}$. Then, while keeping other components constant, the ionic conductivity further improved by varying EC content as weight ratios to the polymer as 0.75, 1.00, 1.25 and 1.50. The highest ionic conductivity was achieved as $7.27 \times 10^{-3} S\,cm^{-1}$ at room temperature for the 1.5 EC weight ratio, suggesting a synergistic effect in enhancing electrochemical performance. Interactions between polymers and salts were confirmed through FTIR measurements.

Key words: Lithium ion batteries, gel polymer electrolytes, PVDF polymer, ionic conductivity