

Souvenir

International Conference on Recent Trends in Materials Science

RTMS-2024

(Under UGC Autonomous Grant)

01st March, 2024



Organized by

PG & Research Department of Physics
Arul Anandar College (Autonomous)

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Karumathur – 625 514
Madurai District, Tamilnadu.

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Performance Study of Sodium Alginate (SA) with Lithium Chloride (LiCl) based Solid-State Membrane as an Electrolyte in Electrochemical Device Application

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Abstract

In this article, we present a novel solid biopolymer based membrane (BPMs) with Sodium Alginate (SA) as host material incorporated with an ionic salt, Lithium Chloride (LiCl). Solid BPMs are prepared using the solution casting technique and used as an electrolyte in the fabrication of solid state Li-ion conducting battery and coin cell. The X-Ray diffraction (XRD) method has been carried out to analyze the crystalline/amorphous nature of the membrane. The ionic conductivity of all prepared BPMs is measured using AC Impedance analysis, and the membrane with the composition of 15 mol% of SA:85 mol% of LiCl exhibits a high ionic conductivity of 3.06×10^{-2} S/cm. The glass transition temperature (T_g) of the prepared BPMs is examined using Differential Scanning Calorimetry (DSC), and the membrane of 15 mol% of SA:85 mol% of LiCl exhibits a decreased T_g value of 54.33 °C. Transference number measurement (TNM) is made to assure that the major charge carriers involved in transportation are ions. Using the highest ion conducting membrane as an electrolyte, a primary Li-ion conducting battery has been fabricated which results with an OCV of 1.91 V and various loads are connected to observe the corresponding current drawn from the cell. A coin cell is constructed with the configuration of Graphite (G) + Tannic Acid || 15 mol% of SA:85 mol% of LiCl || LiFePO₄ + G + Pinch of Highest ion conducting membrane and the Galvanostatic charge-discharge (GCD) analysis is carried out to analyze the rechargeable nature of the prepared membrane and the performance of the coin cell whereas the cell has undergone charge/discharge process for 200 cycles and resulted with an Energy density of 13.94 Wh/Kg, Power density of 1111.11 W/Kg and Specific Capacitance of 100.40 F/g respectively.

Keywords: Biopolymer, Sodium Alginate, Lithium Chloride, Li-ion conducting coin cell, Galvanostatic charge-discharge analysis

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EQUALITY of status and of opportunity; and to promote among them all
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Integrity of the Nation."



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