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CONDUCTIVITY STUDY ON PLASTICIZED SOLID BIO-ELECTROLYTES CMC-NH¬4BR AND APPLICATION IN SOLID-STATE PROTON BATTERIES

A. S. Samsudin[a*], M. I. N. Isa[b]

[a]Advanced Materials Research Cluster, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia
[b]Advanced Materials Team, School of Fundamental Sciences, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia·

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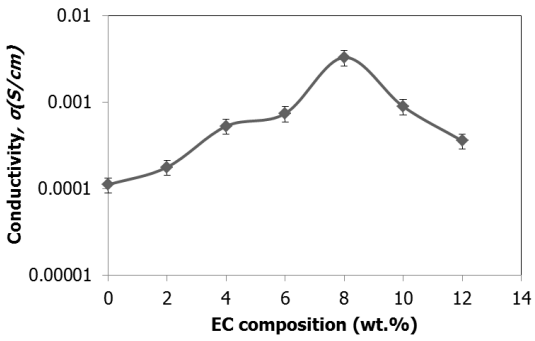
*Corresponding author
ahmadsalihin@ump.edu.my

Graphical abstract



Abstract

This paper present the development of plasticized solid bio-electrolytes (PSBs) which has been accomplished by incorporating various composition of plasticizer namely ethylene carbonate (EC) with carboxy methylcellulose doped NH4Br via solution casting method. The plasticized polymer–salt ionic conduction of PSBs has been analyzed by electrical impedance spectroscopy. Plasticization using EC in PSBs system assists the enhancement of NH4Br dissociation and therefore increases the protonation process in the system. The highest ionic conductivity obtained for CMC−NH4Br containing with 25 wt. % NH4Br was achieved at 1.12 x 10-4 Scm-1 and improved to 3.31 x 10-3 Scm-1 when EC was added in PSBs system. The ionic conductivity-temperature for PSBs system was found to obey the Arrhenius relationships where the ionic conductivity increases with temperature. The solid-state proton batteries were assembled with the formation of Zn + ZnSO4.7H2O || highest conducting PSBs system || MnO2 and achieve with a maximum open circuit voltage (OCV) of 1.48 V at room temperature and showed good in rechargeablity performance with more than 10 cycles.

Keywords: Bio-electrolytes, ionic conductivity, solid-state proton batteries, discharge capacity

1.0 INTRODUCTION

Solid electrolytes based on polymer materials have acknowledged great attentions in electrochemical devices application due to their advantages [1]. In comparison to synthetic polymer, polymer natural based have been stated to be highly potential and suitable for expansion in polymer electrolytes system and this due to their good properties and low-cost materials [2, 3]. Amongst those types of biopolymer, carboxymethyl cellulose (CMC), a natural anionic polysaccharide which is widely used in many industrial and research sectors [4-6].

Generally, solid electrolytes based polymer-salt complexes are normally insufficient for the application in electrochemical device due to low in ionic conductivity [7]. In order to improve polymer electrolytes with high conductivity, several methods had been conducted such as polymer blending, copolymerization and addition of ceramic filler or plasticization in polymer-salt complexes. Plasticization is most common technique use by researchers in order to