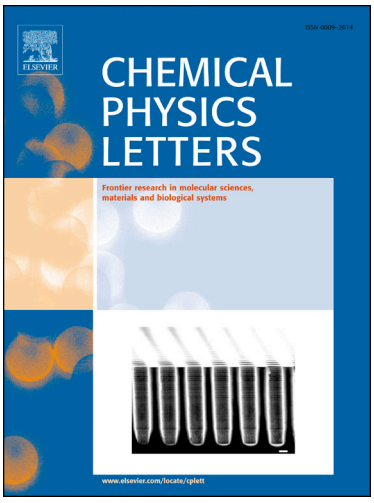

Research paper

Electrical, Dielectric and Electrochemical Characterization of Novel Poly(acrylic acid)-based Polymer Electrolytes Complexed with Lithium Tetrafluoroborate

Koh Sing Ngai, S. Ramesh, K. Ramesh, Joon Ching Juan

PII: S0009-2614(17)31061-8
DOI: https://doi.org/10.1016/j.cplett.2017.11.042
Reference: CPLETT 35256

To appear in: *Chemical Physics Letters*

Received Date: 22 September 2017
Accepted Date: 20 November 2017

Please cite this article as: K. Sing Ngai, S. Ramesh, K. Ramesh, J. Ching Juan, Electrical, Dielectric and Electrochemical Characterization of Novel Poly(acrylic acid)-based Polymer Electrolytes Complexed with Lithium Tetrafluoroborate, *Chemical Physics Letters* (2017), doi: https://doi.org/10.1016/j.cplett.2017.11.042

Electrical, Dielectric and Electrochemical Characterization of Novel Poly(acrylic acid)-based Polymer Electrolytes Complexed with Lithium Tetrafluoroborate

Koh Sing Ngai[a], S. Ramesh[a*], K. Ramesh[a], Joon Ching Juan[b]

[a]Centre for Ionics University of Malaya, Department of Physics, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia
[b]Nanotechnology & Catalysis Research Centre (NANOCAT), Institute of Postgraduate Studies (IPS), University of Malaya, 50603 Kuala Lumpur, Malaysia

Corresponding author: rameshtsubra@gmail.com

Abstract

A series of novel poly(acrylic acid)-based polymer electrolytes with high conductivities at room temperature has been prepared and studied. Polymer electrolytes composed of poly(acrylic acid) (PAA) and lithium tetrafluoroborate ($LiBF_4$) were prepared by means of solution casting. The effect of the addition of $LiBF_4$ on the properties of the PAA-based electrolyte matrices was analysed and investigated using impedance spectroscopy. The optimized PAA-based solid electrolyte showed an electrochemical stability window of 3.2 V. Thermogravimetric analysis indicated that the incorporation of $LiBF_4$ into PAA matrix enhances the thermal stability. The structural properties of polymer electrolytes were studied by using X-ray diffraction analysis.

Keywords: Poly(acrylic acid), Lithium tetrafluoroborate, Polymer electrolyte, Ionic conductivity, Dielectric permittivity

1. Introduction

Liquid electrolytes are used in the production of batteries and other electrical devices for the past few decades. There are shortcomings of conventional liquid electrolytes such as internal shorting, and potential leaking of corrosive solvent and harmful liquid or gas [1,2]. In 1973, polymer electrolyte was introduced by Fenton et al [3]. Solid polymer electrolytes have several inherent advantages over the conventional liquid electrolytes. Polymer electrolytes have drawn a great deal of attention due to their technological applications in advanced electrochemical devices such as capacitors, batteries, electronics and electrochromic devices [1,2,4]. These polymer electrolytes possess interesting properties over their liquid counterparts such as flexibility for various shape configuration and thin-film forming ability [5,6]. At the same time, polymer electrolytes are used as separators in lithium-ion and lithium-polymer batteries due to their chemical and thermal properties. Other inherent advantages and promising features of the polymer electrolytes make them widely used in the battery application [7].

The development of new polymer electrolytes with enhanced features and characteristics has become an important research area in the recent years. A polymer electrolyte is composed of at least one inorganic salt embedded in a host polymer matrix [8,9]. Examples of host