NANOCOMPOSITE POLYMER ELECTROLYTE FOR PRIMARY ALKALINE BATTERY

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ABSTRACT

In this study, polyvinyl alcohol (PVA) was used as the host polymer, potassium hydroxide (KOH) as the ionic dopant and titanium dioxide (TiO_2) as the inorganic nanofiller. Solid polymer electrolytes consisting of PVA with varied concentration of KOH ranging from 0.5M to 2.5M in the interval of 0.5M were prepared using solution cast method. Pellet for each samples were prepared and analyzed using impedance spectroscopy. The highest conducting sample was chosen to be added with 3 wt% to 15 wt% TiO_2 nanofiller to further enhance the conductivity. The conductivity value of the highest conducting sample of PVA of KOH was found to be 4.52×10^{-4} Scm^{-1} and upon the addition of nanofiller, the conductivity increased to the maximum value of 1.44×10^{-3} Scm^{-1}. The ionic conductivities for each sample were compared to observe the effects of addition of nanofiller. Impedance spectroscopy studies, dielectric studies and modulus formalism studies have been conducted to provide the understanding of these effects. These studies showed that addition of nanofiller increases the ionic conductivity of the solid polymer electrolytes and the polymer systems prepared are ionic conductors. Fabrication and characterization of primary alkaline batteries were also carried out to understand its behavior.

CHAPTER 1

INTRODUCTION

1.1 Background

For the past few years, extensive efforts have been directed toward the development of solid-state batteries. The advance of Information Technology has put portable and rechargeable batteries into important need as the most convenient portable power source that is also efficient. Reducing the consumption of fossil fuel for energy and continuous awareness to preserve the quality of the environment has been an important issue that is widely discussed on the entire globe (Takamura, 2002).

Recent research attempted several ways to obtain practical solid-state batteries. Many studies reported that solid-state Li ion batteries have been preferred due to its large electrochemical stability window and the availability of good lithium ion conductor. However, high cost and difficulty in handling and safety issues has made scientists to develop proton conductors with high ionic conductivity. Even though having smaller electrochemical stability window, proton batteries is still considered as good, cost effective alternative (Lakshmi et al., 2002). Recently, proton conducting polymer electrolyte has attracted attention because its viability and ease of handling (Pratap et al., 2006).