ELECTRICAL PROPERTIES OF MG-30/NANOFILLER-BASED POLYMER ELECTROLYTES FOR LITHIUM BATTERIES

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ABSTRACT

ELECTRICAL PROPERTIES OF MG-30/NANOFILLER-BASED POLYMER ELECTROLYTES FOR LITHIUM BATTERIES

In this study, 30% methyl grafted natural rubber (MG-30) containing fixed amount of lithium trifluoromethanesulfonate ($LiCF_3SO_3$) or LiTf salt and ethylene carbonate, EC and different concentration of SiO_2 nanofiller were prepared using the solution cast technique. Impedance spectroscopy technique was used to determine the electrical conductivity of the samples. The optimum electrical conductivity obtained was 2.36×10^{-4} S cm^{-1} with the composition of 35wt% MG-30:65wt% LiTf:65wt% EC:1.5wt% SiO_2. The conductivity was calculated using the bulk resistance value what was obtained from the complex impedance plot in the frequency range from 100Hz to 1MHz. The ionic transference number obtained from the Wagner's polarization method is 0.986 which indicates the samples are ionic conductors.

CHAPTER 1

INTRODUCTION

1.1 Introduction

A polymer can be defined as a compound consisting of a large number of repeating units, called monomers. These monomers are joined together by covalent bonds to form a polymer. The physical and chemical properties of the polymer depends on the overall size of the polymer chain and on the inter- and intra-molecular forces that hold the polymer together. They do not possess any segmental motions at low temperature (below glass transition temperature, T_g) and are normally insulators. According to Wright et al., (1973), the polymer become ionically conducting when inorganic salts are being added in them. The polymer, act as host, while an inorganic salt dissociate to provide mobile species. Polymer salt complexes that exhibit good ionic conducting are useful for the development of electrochemical devices. Generally, the ionic conductivity in polymer salt complexes is due to the mobility of the conducting species contributed by the inorganic salts which dissociates into ions. The ability of polymer to allow ions to move in their matrix is known as polymer electrolyte. Good polymer electrolytes should possess high ionic conductivity and poor electronic conductivity. Most studies in this field are devoted to poly(methyl methacrylate), PMMA based polymer electrolyte using lithium salts to form polymer salt complexes. However, the main drawbacks of these electrolytes