PREPARATION AND CHARACTERIZATION OF COMPOSITED POLYMER ELECTROLYTES FOR ALUMINUM-AIR BATTERY

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ABSTRACT

Composite gel polymer electrolyte consist of cellulose acetate (CA), aluminum per chlorate (Al_3ClO_4), dimethylformamide (DMF) solvent and silicon oxide (SiO_2) filler have been prepared. Liquid electrolyte composing of different molarities Al_3ClO_4 in DMF solvent have initially been prepared. The highest conductivity obtained for this system is $6.11x10^{-3}$ Scm^{-1} when the selected 0.9M liquid electrolyte is introduced. Upon the addition of 5wt% of CA as polymeric gelling agent into the selected 0.7M liquid electrolyte, the conductivity is enhanced by ~ 21% to the maximum of $4.85x10^{-3}Scm^{-1}$. SiO_2 is added into the highest conductivity gel polymer electrolyte system in order to increase the mechanical properties. The highest conductivity obtained for the composited polymer electrolyte is $6.12x10^{-3}$ Scm^{-1} when 3wt% SiO_2 is added. The highest conducting composited polymer electrolyte sample is then chosen as an electrolyte in fabrication of aluminum air cells. The cells have been characterized according to their open circuit voltage (OCV). It has been found that the initial OCV at 1.65 V is obtained and constant at ~1.3 V for more than 24 hours.

CHAPTER 1

INTRODUCTION

1.1 Background

Metal/air batteries show a high energy density, a flat discharge voltage and long shelf life. As such zinc is an excellent metal for use in a metal/air battery because of its stable in alkaline electrolytes. Metal/air batteries either use alkaline or neutral electrolytes. Other metals such as lithium, calcium, magnesium, aluminum, or iron may be used in metal/air batteries.

In metal/air batteries, the reactive anode and air electrode result in an inexhaustible cathode reactant. The performance of these batteries can be affected in several ways. Limitations in the oxygen or air electrode of metal/air batteries cause voltage to decrease sharply with increasing current; therefore, these batteries are appropriate for applications that require low to moderate power. Carbon dioxide can be absorbed by the battery, which may lead to carbonate crystallization in the air electrode, decreased performance, and may cause damage. Systems recharged electrically allow the oxidation of catalysts and electrode supports during charging. In addition, an effective air electrode must be utilized for adequate performance.

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