STRUCTURAL AND IONIC CONDUCTIVITY STUDIES OF MgI_2 - $Mg_3(PO_4)_2.5H_2O$ SOLID ELECTROLYTES

MOHD KHAIRUL HAZWAN BIN MOHD YUSOF

BACHELOR OF SCIENCE (Hons.) CHEMISTRY
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

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ABSTRACT

STRUCTURAL AND IONIC CONDUCTIVITY STUDIES OF MgI_2-$Mg_3(PO_4)_2.5H_2O$ SOLID ELECTROLYTE

In this study, MgI_2 and $Mg_3(PO_4)_2.5H_20$ was ball milled and pelletized to make it as magnesium solid electrolyte. This study was conducted to determine the optimum composition of Mg-based solid electrolyte where MgI_2 - $Mg_3(PO_4)_2.5H_2O$ pellets are used for investigating maximum ionic conductivity and also it structural properties. A maximum conductivity of 7.00×10^{-4} S cm^{-1} was obtained with composition of weight 30% MgI_2 and 70% $Mg_3(PO_4)_2.5H_2O$. The milling time was 1 hour that gave the optimum value of conductivity. FTIR analysis shows there is a strong interaction between these two pure samples thus resulting a higher conductivity to produce a higher performance of solid electrolyte. XRD patterns shows that MgI_2 salt is more crystalline compared to pure $Mg_3(PO_4)_2$ salt. There is a formation of new complex that gave maximum conductivity value to the magnesium solid electrolyte. The appearance of new peak at 56.36° in the XRD diagram for 30% MgI_2 – 70% $Mg_3(PO_4)_2$ composition indicates complexation has occurred thus giving a high value of conductivity.

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CHAPTER 1

INTRODUCTION

1.1 Background

The rapid growth on the development in the world of advance materials has become a widely renowned and recognize to the society. It now gives many applications in our daily life to enhance the living quality of humankind. One of the contributions in this field is the development of solid state rechargeable batteries. The development of solid state magnesium batteries has gain quite a lot of attention due to it's similarities to lithium batteries. Lithium batteries are widely used but the limitation of using lithium as solid electrolyte is to combat the lithium instability.

Magnesium metal is the eight most abundant element and it constitutes about 2% of the Earth's crust by weight. It is also the third most plentiful element dissolved in seawater. Besides that, because of it stability, magnesium isotopes has been found in the application in isotopic geology. Elemental magnesium is a fairly strong, silvery-white, light-weight metal compared to lithium. It slightly tarnishes when exposed to air, although unlike the alkaline metals, storage in an oxygen free environment is unnecessary because magnesium is protected by a thin layer of oxide which is fairly impermeable and hard to remove. Magnesium belongs to the alkaline earth metal group therefore does not occur combination with other elements. It is found in large deposits of magnesite, dolomite, and other minerals. Magnesium metal has been used