EFFECT OF Li ADDITION ON ELASTIC AND STRUCTURAL PROPERTIES OF $35V_2O_5$-$(65-x)TeO_2$-xLi_2O

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ABSTRACT

Tellurite $35V_2O_5$-$(65-x)TeO_2$-xLi_2O:(x=10-50mol%) glass system with reduction of TeO_2 and Li_2O addition have been prepared by melt-quenching method. Elastic properties together with structural properties of the glasses were investigated by measuring both longitudinal and shear velocities using the pulse-echo-overlap technique at 5MHz and Fourier Transform Infrared (FTIR) spectroscopy, respectively. Ultrasonic velocities(V_L and V_S) ,independent longitudinal and shear modulus (L and G),Bulk and Young`s modulus ( K and $G$) ,Debye temperature and Poisson`s ratio were observed to initially increase at x=20 mol% were suggested due to strengthen of glass network rigidity as a result of BO ions was more dominance compared to NBO ions for this glass composition. Shear, G and Young`s, E modulus showed decreasing trend for addition of Li_2O at x>20 mol%. FTIR analysis showed an increase in non-bridging oxygen (NBO) as indicated by the increase in intensity of VO_4 assigned peaks and the decrease in intensity of TeO_4 assigned peaks for x>20 mol% indicates that Li acts as a modifier in the glass network.

CHAPTER 1

INTRODUCTION

1.1 Background Study

Glass is an amorphous (non- crystalline) solid usually formed by the solidification of a melt without crystallization. Compared with crystals, the structure of glass is devoid of a regular arrangement with no long range order of atoms in a reciprocal lattice [8].

Tellurium dioxide (TeO_2) does not have the ability to form a glass without a modifier like alkali, alkaline earth and transition metal oxide or other glass modifier [5]. Tellurite glasses have high dielectric constant and electrical conductivity [1] and high level of infrared transmission[9].TeO_2-V_2O_5 glasses studies have been the subject of high interest. The binary TeO_2-V_2O_5 system shows wide glass-forming region and semiconducting properties [2,10].

Ternary lithium-vanadotellurite glasses have been extensively studied [1,3,10]. Previous study showed binary TeO_2-V_2O_5 displays a good cyclability with respect to lithium intercalation [2].Addition of alkali in tellurite glasses show ionic conduction, whereas addition of transition metal oxide makes them mixed electronic-ionic conductors[8].Studies from Jayasinghe et al.,1999 reported mixed electronic-ionic conduction in ternary $3TeO_2$-$(1-x)V_2O_5$-xLi_2O glasses at x=0.5,and Montani et al.,2001 also observed the transition from typical electronic to ionic conduction at x=0.6 in ternary xLi_2O-$(1-x)V_2O_5$-$2TeO_2$ glasses .The change over of conduction mechanism from one regime to the other is a useful phenomenon as such glasses can be used in integrated batteries either as electrodes or as electrolytes [1,8].The changes in conduction mechanism from electronic to ionic is suggested to be due to structural changes in the glass system [2].However, studies on effect of Li_2O addition on elastic properties of ternary V_2O_5-TeO_2-Li_2O have not been previously reported and how the structural changes is related to changes of elastic properties of glass is unknown.