ABSTRACT

In this work the phase transformation of the samples contain three different ratios of the elements, Selenium,Germanium and Indium was studied by using the change in dielectric constant and dielectric loss tangent.

The disorder- order transformation has been verified using four parts from each sample. These parts were annealed at 120,130,140 and 150^0 C by the step wise method.

The bulk of this work was belt up at three different stages:-

FIRST STAGE:-

The physical properties of the system Se_{90} Ge_{10-x} In_x in the glassy state:-

a: The glassy nature of the ingot samples was confirmed by X-ray.

b: The glass transition temperature (T_g),crystallization temperature (T_c) and the melting temperature (T_m) were specified by DTA thermograms.

c: The temperature dependence of the dielectric constant,dielectric loss tangent and the electric conductivity show an increment.

d: From the effect of frequency on the dielectric constant , dielectric loss tangent and electric conductivity ,it can be concluded

that the electric conductivity increases while both of dielectric constant and dielectric loss tangent decrease. This has been interpreted in terms of the "CBH" model.

Moreover from the relation $\sigma = A\ \omega^{S}$, the power factor S has been calculated (0.15-0.57).

e: The increasing of Indium content in the system $Se_{90}Ge_{10-x}In_x$ leads to the increasing of each of the electric conductivity and dielectric constant.

SECOND STAGE:-

The physical properties of the system $Se_{90}\ Ge_{10-x}\ In_x$ in the crystalline state:-

From X-ray spectrum it has been detected that the samples have been transformed from glassy state to crystalline state. It has been proved that the unit cell of the crystalline structure was either hexagonal or orthorombic. The increasing of the peak height with annealing temperature indicate the growing up of the crystalline domains on the expense of the old amorphous matrix. This in turn leads to :

1-The increasing of the dielectric constant, dielectric loss tangent and electric conductivity with temperature.

2-The increasing in electric conductivity with frequency, while both of dielectric constant and dielectric loss tangent decrease.

THIRD STAGE:-

The physical properties of the system $Se_{90} Ge_{10-x} In_x$ in the super cooled liquid state:-

The phase transformation from glassy state to the crystalline state has been followed by the change in dielectric constant and dielectric loss tangent at different constant crystallization temperatures,120,130,140 and 150° C and two constant frequencies (70 and 120 Hz) using step wise method.

This was verified using Avrami equation to obtain the crystallization factors,n,k and ΔE_c.

The behaviour of these factors was :-

1-The order of reaction (n) decreases as the crystallization temperature increases.

2-The rate of crystallization (K) increases with the crystallization temperature.

3-The activation energy (ΔE_c)of transformation for both of dielectric constant and dielectric loss tangent increases as the Indium content increases.

4-The diffusion coefficient (D) of the crystalline domains in the amorphous matrix was calculated. Also the geometry of the growing up crystalline domains was specified and it may be either spheres or rods.