INTRODUCTION AND LITERATURE SURVEY

Materials can be classified structurally as crystalline and amorphous (non crystalline). A crystal is defined as a substance consisting of atoms arranged in pattern that repeats periodically in three dimensions (1). Any material which does not meet this criterion of periodically repeated pattern of atoms is amorphous (non crystalline). A distinctive class of amorphous solids is glasses, which is defined as amorphous solid obtained from the melt (solidification of a liquid (2). During glass formation , the viscosity, entropy, volume and internal energy change smoothly and not sharp as in case of crystallization . This change may be rapid in the vicinity of the glass transition temperature T_g . The T_g-value is dependent on the sample thermal history . While most physical properties of glasses (specific volume, viscosity... etc) show some change in the vicinity of T_g , the electrical conductivity of glassy semiconductors is an exception . Vengel observed no change in either the temperature dependence of absolute value of the electrical conductivity upon cooling through the glass transition of several glassy chalcogenides from the As_2Se_3-As_2Te_3, system (3).

The amorphous solids are often defined by their diffraction patterns . That is, the diffraction patterns consist of a few broad holes rather than sharp Bragg reflections . However, markedly different structures can lead to qualitatively the same diffraction patterns .

The crystallization of an amorphous material proceeds by the process of nucleation and growth, and the crystallization rate is suppresed reducing either (or both) of these processes. Light can produce a marked enhancement of the crystallization kinetics over that obtained from purely thermal effects (4). Light irradiation often produces both photo and thermal effects which are difficult to resolve . Electric field can also play an important role in crystallization . It has been found that, the crystallization of an $As_{11} Te_7 Ge_2$ alloy by using an electric field always nucleated at the positive voltage electrode and grow towards the negative one (5). If the voltage was reversed before a complete formation of a crystalline filament, new filament observed to nucleate at the new positive electrode. Feinleib, has suggested that the electric field enhances crystallization kinetics by producing excess electron-hole carriers (6) .

Theoretical work on the band structure of amorphous semiconductors has suggested a model to discuss the conduction process (7,8,9). It has been shown that the extended states can form an energy band rather similar to those for a crystal and that the localized states occur towards the edges of the bands, extending them beyond where they would cut off in crystalline material as shown in Figure (1.1). The energies marked E_v and E_c correspond to the band edges of crystalline material . Those marked E_{th} and E_{tc} correspond to the sharp division between localized and extended states near what would be the top of the valence and bottom of the conduction band respectively. The regions occupied by localized states are shown shaded . However, this ideal conduction is unlikely to be attainable and that the tails of the bands may overlap so that there exist localized states through out the space between E_c and E_v as shown in Figure (1.2). According to Mott the conductivity in the localized states is forbidden and the mobility corresponding to them is zero(10) . Thus instead of an energy gap we have a mobility gap ΔE_u as shown in Figure (1.3). It is seen that ΔE_u is less than ΔE, the forbidden energy gap for crystalline material. The mobility gap can account for the activation energy generally found for conduction processes .