AMERICAN SCIENTIFIC PUBLISHERS

Advanced Science Letters
Vol. 20, 1360–1363, 2014

Dc, Ac Conductivity and Dielectric Analysis of SeTe Alloy

Mohsin Ganaie, Shabir Ahmad, Shama Islam, and M. Zulfequar*

Department of Physics, Jamia Millia Islamia, New Delhi 110025, India

Measurement of dc, ac conductivity and dielectric analysis of the SeTe alloy. The material which is in the form of pallet is prepared by melt quenching technique. The Temperature dependent dc conductivity of SeTe alloy in the temperature range of (290–450 K) has been measured, which shows the conduction is mainly due to thermally activated process. Ac conductivity and dielectric properties has been found in the temperature range of 290 K–360 K and at various frequencies 1 KHz–900 KHz. The ac conductivity is found to obey the ω^s law, ac conductivity increase with increases of frequency, which is probably due to relaxation caused by the motion of charge carriers. This is interpreted in term of CBH model. The dielectric values decrease with frequency response and increase with temperature. An analysis of the dielectric loss data shows the Guintini's equation that agree with the theory of hopping of charge carrier over a potential barrier as suggested by Elliot's.

Keywords: Dc Conductivity, Ac Conductivity, Dielectric Constant.

1. INTRODUCTION

The transport properties of charge carriers in amorphous semiconductor have become the subject of intensive research by many workers from last six decade. The existence of Sharpe mobility edges at energies where the wave function changes its nature from localized to extend, which for a long time was only a matter of speculation, has found some grounds in some experimental on electronic transport. Se based alloy show high transparency in mid I–R region, non-linear properties and also have a variety of photo-induced effect, which are useful for all-optical switching.[1,2] Several impurities like Ga, Zn, S, Cu etc. are alloyed with a-Se to modify its prosperity[3,4] due to which these alloy are now-a-days used in xerography.[5] Since the advantage of electrographic, a-Se has achieved important application for industrials use. Its device application including ultra high density phase change memory, photo voltaic, photo-receivers, photo-detector, switching memory, change of electrical resistance and the optical reflectivity.[6–9] Thus the study of transport properties of these materials is extremely important.

A good amount of work is done dc conduction contact capacitance, spectral properties, ac conduction, structural and magnetic properties have been reported. The dielectric behavior study has been extensively used to reveal structural information and dielectric losses as well. Also the frequency dependent conductivity of amorphous compound is important to understand conduction in these glasses. The aim of the present paper is to study the electrical conductivity and dielectric properties for SeTe alloy has been study to understand conduction processes. The result are discusses on the basis of (CBH) model. The frequency range usually covered in the measurement extends from 1 KHz–900 KHz.

2. EXPERIMENTAL DETAILS

Bulk multi component glassy materials of composition SeTe glassy alloy has been prepared by the quenching technique. Selenium, Tellurium of high purity (99.999%) was weighed by electronic balance accurately and was sealed in quartz ampoules under high vacuum of 10^{-6} mbar. The ampoules are heated in a furnace to a temperature of 900 K for 12 hours to make the melt homogenous. The ampoules were the quenched in ice cooled water to obtain glassy alloy. The prepared materials were obtained after breaking the ampoules. The ingots were grinded to get the powder of the materials. The pellets are made from the powder by applying a load of 5 tons. To obtain a good electrical contact pallet are coated on both side with silver paste.

3. RESULTS AND DISCUSSION

3.1. Dc Conductivity

The conduction process in amorphous semiconductor involves the temperature dependent Dc conductivity. Figure 1 show the Dc conductivity (σ_{dc}) of SeTe in a temperature range of 290–450 K at a constant voltage of 1.5 V. It is clear from the graph that Dc

*Author to whom correspondence should be addressed.

1936-6612/2014/20/1360/004 doi:10.1166/asl.2014.5550