Thermophysical and Structural Investigations of Ge-S-Ag Chalcogenide Glasses

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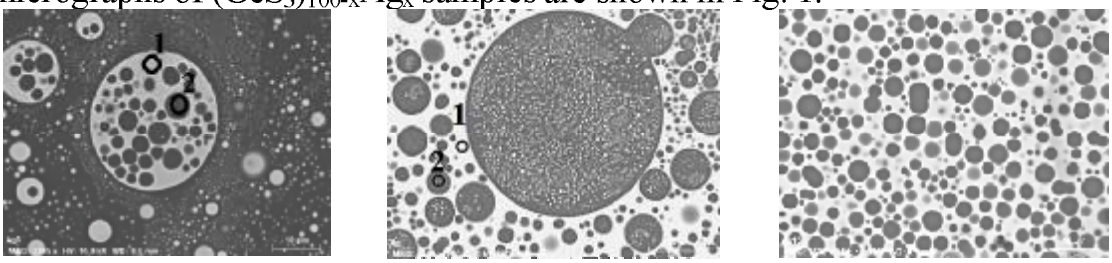
This work presents the results of thermodynamic and structural investigations of rapidly GeS_3, $(GeS_3)_{100-x}Ag_x$ alloys and $Ge_{42}S_{58}$, $(Ge_{42}S_{58})_{100-x}Ag_x$ alloys (x= 5, 10, 15, 20, and 25 at.%).

The thermal properties of the amorphous alloys were investigated using a differential scanning calorimeter NETZSCH DSC 404. All compositions $(Ge_{42}S_{58})_{100-x}Ag_x$ show a single glass transition. The glass transition temperatures decrease with the increase of silver.

X-ray diffraction data measurements were taken at the BW5 high energy x-ray diffractometer (Hasylab). The energy of incident radiation was *100.0 keV (λ=0.124 A)*. Raw data were corrected for background scattering, detector deadtime, and Compton scattering.

Images of glass surfaces at various magnifications were recorded using the ZEISS Digital Scanning Electron Microscope DSM 982 Gemini. SEM micrographs of $(GeS_3)_{100-x}Ag_x$ samples are shown in Fig. 1.



x =5 at.% x =10 at.% x =15 at.%

Fig. 1. SEM micrographs of the $(GeS_3)_{100-x}Ag_x$, glasses.

Energy dispersive X-ray analysis (EDX) techniques were used to investigate the phase separation of the $(GeS_3)_{100-x}Ag_x$. As expected, the images of the matrix (GeS_3) and the $(GeS_3)_{75}Ag_{25}$ glass reveal homogenous glasses. Light and dark regions of the other images correspond to Ag-rich and Ag-poor phases, respectively. Interestingly, the larger Ag-rich domains contain inclusions of Ag-poor phase of various sizes. For higher Ag concentrations, i.e. for x = 15 at.%, the situation changes drastically and the Ag-rich phase becomes the dominant one.

Similar SEM images and EDX spectrum were obtained for $(Ge_{42}S_{58})_{100-x}Ag$, bat the samples exhibits no phase separation, while at x = 25 at.% the Ge cristalls in the glassy matrix is observed.