Molecular structure of Si$_x$Ge$_x$Te$_{100-2x}$ glasses

K. GUNASEKERA, P. BOOLCHAND, University of Cincinnati, S. MAMEDOV, Horiba Jobin Yvon Inc., New Jersey — Bulk glasses of the titled ternary have been synthesized in the $8\% < x < 16\%$ range by melt quenching. Glass transition temperatures, $T_g(x)$, increase linearly from $140^\circ C$ at $x = 8\%$ to $200^\circ C$ at $x = 12\%$, then decrease steadily to $160^\circ C$ thereafter. The non-reversing enthalpy of relaxation at $T_g$ shows a broad minimum near $9\%$ but a maximum near $12\%$. Glasses appear to be fully polymerized at $x < 12\%$, but segregate as $x > 12\%$. The broad minimum near $9\%$, most likely, represents the opening of an Intermediate Phase. Raman scattering, excited using 785 nm radiation of a glass at $x = 10\%$, shows two modes, a broad one near $160$ cm$^{-1}$ and a narrow one near $127$ cm$^{-1}$. A mode near $157$ cm$^{-1}$ has been previously identified with polymeric Te$_n$ chains of a-Te. Tentatively, we assign the $127$ cm$^{-1}$ mode with face-sharing $\text{GeTe}_4$ and a mode near $170$ cm$^{-1}$ with edge-sharing $\text{SiTe}_4$ tetrahedra in these glasses. The nature of glass structure evolution with composition will be elucidated.

1Supported by NSG grant DMR-08-53957.
2M. Brodsky, Phys. Stat. Solidi(b) 52, 609 (1972)