

## Investigation of physical ageing effect in $\text{Se}_{90}\text{In}_4\text{Sn}_6$ glass

### Abstract

Physical ageing effect in ternary  $\text{Se}_{90}\text{In}_4\text{Sn}_6$  glass has been detected, using differential scanning calorimeter (DSC), under the influence of  $\text{Co}^{60}$   $\gamma$ -irradiation, natural storage, and both. The number of Lagrangian constraints per atom ( $n_c$ ) of the investigated  $\text{Se}_{90}\text{In}_4\text{Sn}_6$  glass comes out to be 2.9. This reveals that the studied material belongs to a floppy glass with under-constrained glassy network and hence one expects it to undergo physical ageing effect. It is observed that  $\gamma$ -irradiation increases the glass transition temperature  $T_g$  and the endothermic peak area  $A$ , which is directly related to the relaxation enthalpy loss. The estimated value of  $A$  of  $\gamma$ -irradiated glass is slightly higher than that of un-irradiated glass, indicating that thermodynamic equilibrium state of super-cooled liquid is still not reached and further storage is required. In addition, pure natural storage increases also the two ageing parameters ( $T_g$  and  $A$ ) where the value of  $A$  is nearly four times greater than that of un-irradiated glass. This indicates that a significant natural ageing effect is evident in the studied glass and a structural relaxation process towards a more equilibrium state can be attained. Moreover, for  $\gamma$ -irradiated  $\text{Se}_{90}\text{In}_4\text{Sn}_6$  glass which has been aged for 8 years, a small increase in the  $A$  value is evident, which reveals that  $\gamma$ -irradiation modifies its covalent-bonded glass network towards thermodynamically equilibrium extrapolated states of super-cooled liquid. © 2015 Elsevier Ltd.