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Relaxation of permanently densified glasses

Invited Talk

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(GOMD-S1-087-2018) Relaxation of permanently densified glasses (Invited)

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Despite the considerable amount of studies and data on in-situ and ex-situ compression of glasses, very low interest was shown for the reverse transformation, i.e. the relaxation during high temperature annealing, from high density to low density. Densified SiO₂, soda silicate and aluminoborate glasses, obtained from different pressure and temperature routes have been annealed over a wide range of temperatures. In the case of pure silica glass, hot and cold compressions were used to separate the effects of pressure and compression temperature. For soda silicates glasses, the sodium concentration was varied to study the effect of modifiers. And aluminoborate glass will allow us to discuss the effect of the network former elements. In situ micro-Raman / Brillouin spectroscopy, Small Angle X-Ray scattering or Differential Scanning Calorimetry were used to follow the structural and energetic evolution. For pure silica and soda silicate glasses, while density decreases monotonically during ambient pressure annealing, the relaxation takes place through a transitory state, consisting in an increase of the network inhomogeneity seen by both Raman and SAXS. The kinetic is overall faster for cold compressed silica samples as well as for soda silicate glasses. In the case of aluminoborate glasses, a very different dynamic was observed. The relaxations are very fast and their overall dynamics are closer to the relaxation of the glass transition.