Integrated DSC, Raman and Brillouin spectroscopies – multiscale approach for material investigation.

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The new experimental facility combining together Differential scanning calorimeter, Raman and Brillouin spectroscopies was developed and realized. In such experiment the calorimeter gives the energetic response of matter and the vibrational spectrometers observe its elastic and structural evolution. From 0.01 to 10 cm-1 the Brillouin inelastic scattering is sensitive to long range order properties like volume and elastic moduli. From 5 to 200 cm-1 the Raman Terahertz inelastic scattering is related to intermolecular bonds and from 200 to 4000 cm-1 to internal molecular vibrations. The sample environment can be changed in the calorimeter between -70°C and 750°C, using different thermal programs and with diverse atmosphere.

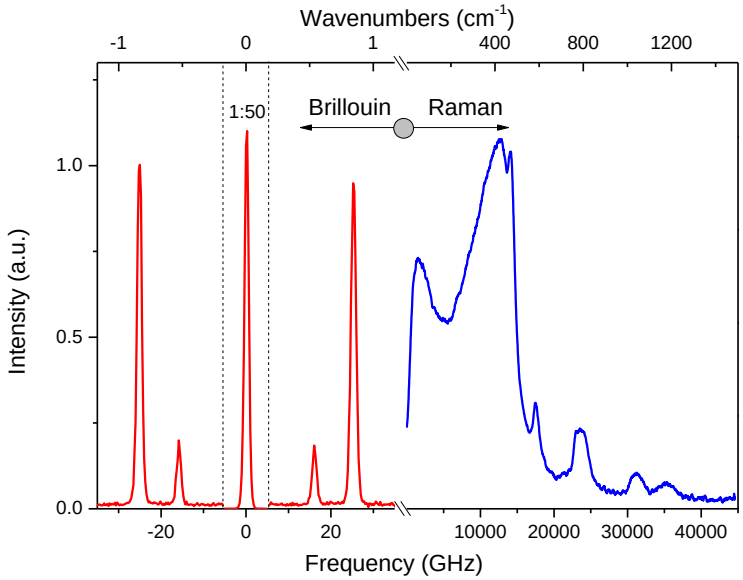

Fig.1. Brillouin and Raman spectra of silica glass. Two pairs of peaks in Brillouin spectrum correspond to longitudinal and transverse acoustic waves in the glass. Raman spectra above 200 cm^{-1} originates from structural units of the glass network.

Doing these observations simultaneously *in situ* is useful to study any transition that impliesseveral order parameters or exhibit relaxation phenomena. For example, they will helpto understand phenomena as different as order–disorder phase transition, glass transition orcrystallization.The technique can be used in field of glass, ceramic, mineralogy, polymers as well as more fundamental study for example ofemulsions.

Results on several studies of model glass and crystalline media are provided to illustrate the possibilities of the equipment. Particularly the approach was applied to study relaxation behavior of borosilicate glasses near the glass transition temperature.