



Plasticity of silicate glasses: indentation and high pressure densification of silica studied by Raman scattering

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Although brittleness is a very well known property of silicate glasses, their plasticity received much less attention. Experimental evidence of the densification process is only possible in restricted geometries such as indentation and Diamond Anvil Cell (DAC) experiments.

In this communication we will show how Raman spectrometric measurements under microscope (micro Raman) are able to provide a map of the residual densification after an indentation in silica glass (1, 2). Both the surface and a section of the samples are studied with a micrometric resolution taking advantage of the sensitivity of the defect D_2 Raman line frequency to the density. Densification rate up to 16% were measured. These densities are calibrated by measurements in Diamond Anvil Cell and lead to a relation between the Raman frequency and the relative densification.

Densification maps are valuable data to test the finite element simulations of the plastic behavior of dense amorphous materials and demonstrate the existence of some discrepancy between the actual behavior of silica and recently proposed models.

1. "Local micro-Raman mapping of indentation induced densification in silica and soda-lime glasses" A. Perriot, V. Martinez, B. Champagnon, D. Vandembroucq and E. Barthel International Congress of Glasses 2004, Kyoto (Japan)

2. "Raman micro-spectroscopic map of plastic strain in indented amorphous silica" A.Perriot, V.Martinez, Ch Martinet, B.Champagnon, D.Vandembroucq and E.Barthel submitted Physical Review Letters 2005