Pressure-induced densification of vitreous silica: insight from elastic properties

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In situ high-pressure Brillouin light scattering experiments along loading-unloading paths are used to investigate the compressibility of vitreous silica. An accurate equation of state is obtained below 9GPa using sound velocities corrected for dispersion. Conversely, huge inelastic effects are observed in the range 10-60GPa, unveiling the reversible transformation from the fourfold-coordinated structure to the sixfold one. We find that the associated density changes fully correlate with the average Si coordination number. Decompression curves from above 20GPa reveal abrupt backward coordination changes around 10-15GPa and significant hysteresis (Figure 1). Further, contrary to common wisdom, the residual densification of recovered silica samples can be figured out from the pressure cycles.

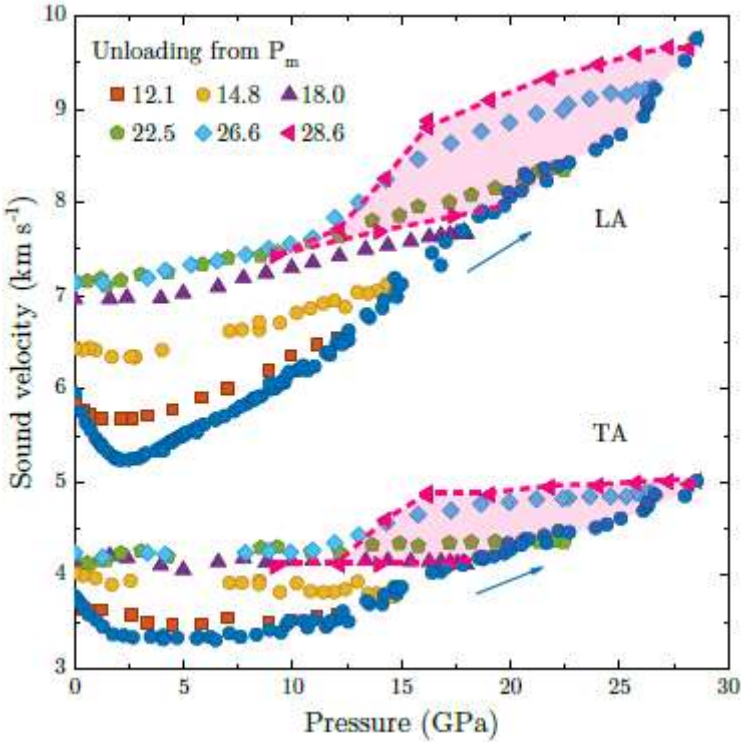

Figure 1. Longitudinal (LA) and transverse (TA) sound velocities in v-SiO2 upon compression (●) and during decompression from various maximum pressures Pm. The pink dashed line is a guide for the eye. [1]

Référence:

[1] Coralie Weigel, Marouane Mebarki, Sébastien Clément, René Vacher, Marie Foret, and Benoit Rufflé, Submit, arXiv:1901.02235