Macroscopic and microscopic study of Glassy GeO_2

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Germanium dioxide is an important material for technology and material science as well as for geophysics and planetary science. It can exist in three polymorphic phases at ambient conditions: quartz, rutile and glass. Generally, GeO_2 is regarded as a chemical and structural analog of SiO_2, in particular, the structure of glassy GeO_2 is a good model for amorphous or molten SiO_2 [1]. All GeO_2 phases have a larger sensitivity to pressure, undergoing pressure-induced changes at much lower pressures than their SiO_2 analogues. However, its phase diagram is poorly studied, especially above Mbar range. Here, we will present an exhaustive macroscopic and microscopic study of laser compressed glassy GeO_2 in the range of pressures up to TPa range. Experiments have been performed at LULI laboratory where equation of state (see figure 1), optical properties and phase transitions using X-ray diffraction [2] along the Hugoniot have been investigated. More recently an experiment on HPLF at ESRF allowed us to complete investigations adding the electronic structural changes and local ionic order measurements using XANES diagnostic.

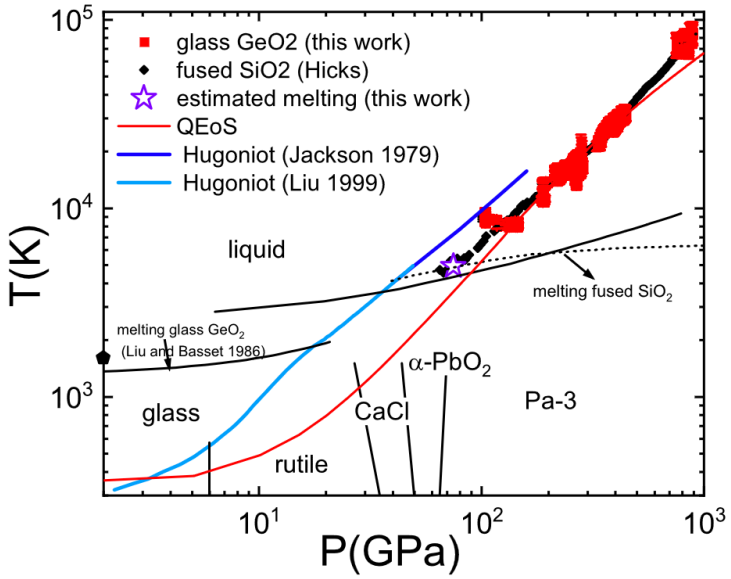

Figure 1: Phase diagram of glass GeO_2 from this work and previous literature (static and dynamic data).

References

[1] V.P. Prakapenka et al., Jour. Phys. Chem. Sol. 65 , 1537 (2004)

[2]A. Denoeud et al. Rev. Sci. Instrum. **92**, 013902 (2021)