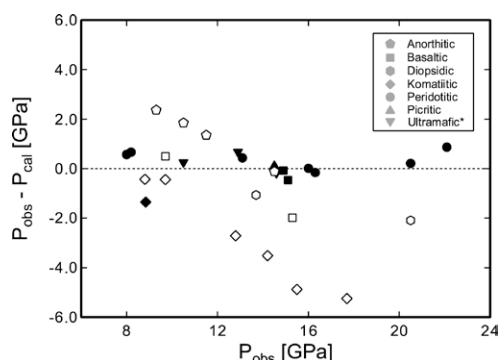# Equation of state for silicate melts: Static vs. shock compression

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We have recently proposed a simple and easy-to-use equation of state for silicate melts, which is applicable to a wide range of chemical composition at the pressure condition of the deep upper mantle [1]. To derive the equation of state, we assumed that silicate melts have a densified network structure (intermediate-range order) based on the knowledge from the behavior of densified SiO_2 glass under high pressure [2]. The equation of state is consistent with all the available density data of silicate melts with an SiO_2 content of about 35-55 mol% measured with large-volume presses between 8 and 22 GPa. However, the equation of state cannot explain shock-compression data. As demonstrated in Fig. 1, there are systematic differences between static- and shock-compression data. Investigation to clarify the reason of the discrepancy is now ongoing.

Figure 1: Deviation of experimental data from the equation of state proposed in Ref. [1] for silicate melts. Solid and open symbols represent static- and shock-compression data, respectively. (*) No specific name is given for the ultramafic data.

[1] Wakabayashi & Funamori (2013) *Phys. Chem. Minerals* **40**, 299-307. [2] Wakabayashi *et al* (2011) *Phys. Rev. B* **84**, 144103.

Element quantification in chondritic components by LA-ICP-MS

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Chondrites comprise the most primitive solar system materials available for laboratory studies. Major and trace element distribution and abundances in different chondritic components provide insights into the early evolution of inner solar system materials. Chondrites are composed of different components (e.g. chondrules, matrix, CAIs etc.) which in turn consist of heterogeneously distributed fine-grained silicates, oxides, sulfides and metals typically on the μm up to some tenth of μm scale. The different phases exhibit different laser ablation characteristics and therefore impair an accurate quantification of elemental concentrations in chondritic components. The use of femtosecond lasers that generate only minimal thermal effects during sampling, produce uniform and fine aerosols, and offer reduced matrix effects compared to nano second laser ablation can diminish this difficulty.

The small-scale chemical heterogeneity of chondritic matter makes the accurate determination of suitable internal standard elements (e.g. by electron microprobe) challenging. This problem can be circumvented if the ablation yield is calculated by the total ablated material [1]. For this purpose, all relevant major elements are analysed relative to an external standard and recalculated as oxides, sulfides, and metals. The ablation yield is then calculated from the sum of major elements. This procedure however requires a suitable external standard for major element calibration in chondrites. Compared to chondrites the commonly used NIST SRM 61x glasses have extremely low amounts of Mg, S and Fe and are therefore poorly suited for this kind of yield correction.

Considering the aforementioned problems, we purchased a nanoparticle based standard material produced by flame spray pyrolysis. This calibration material comprises major and most of the minor elements in approximately CI chondritic abundances with ablation characteristics analogous to NIST SRM 612. Quantitative analysis of the calibration material by solution nebulization ICP-MS showed good agreement with CI chondritic abundance for most elements. Measurement setup, data evaluation and applicability of the approach, composition and homogeneity of the new reference material will be presented and discussed.

[1] Liu *et al* (2008) *Chem. Geol.* **257**, 34-43.