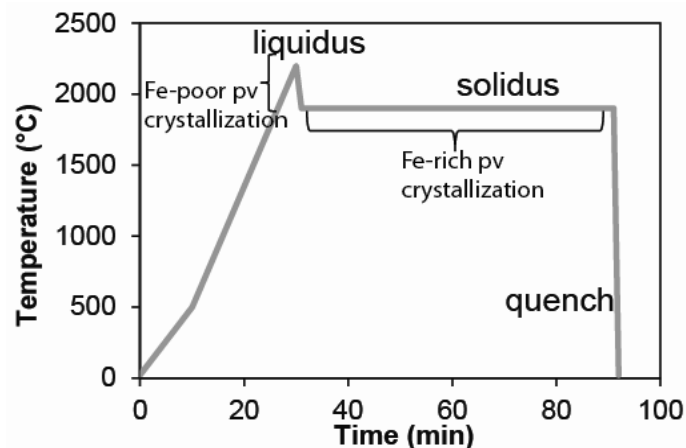
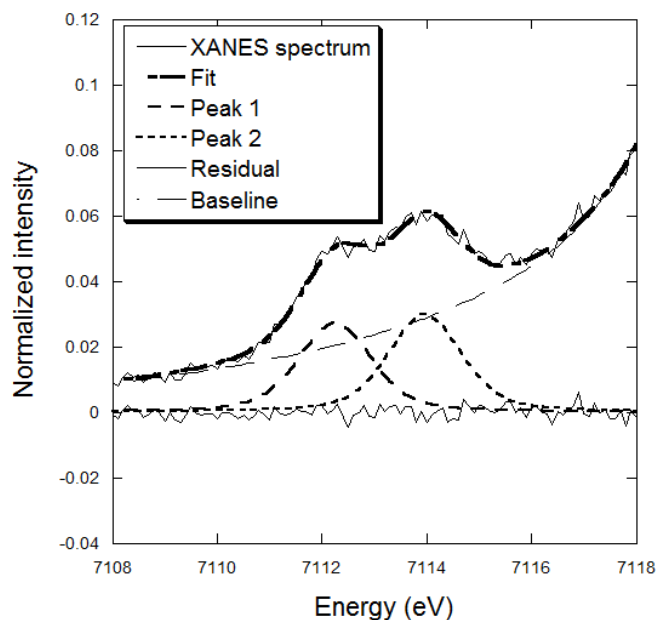


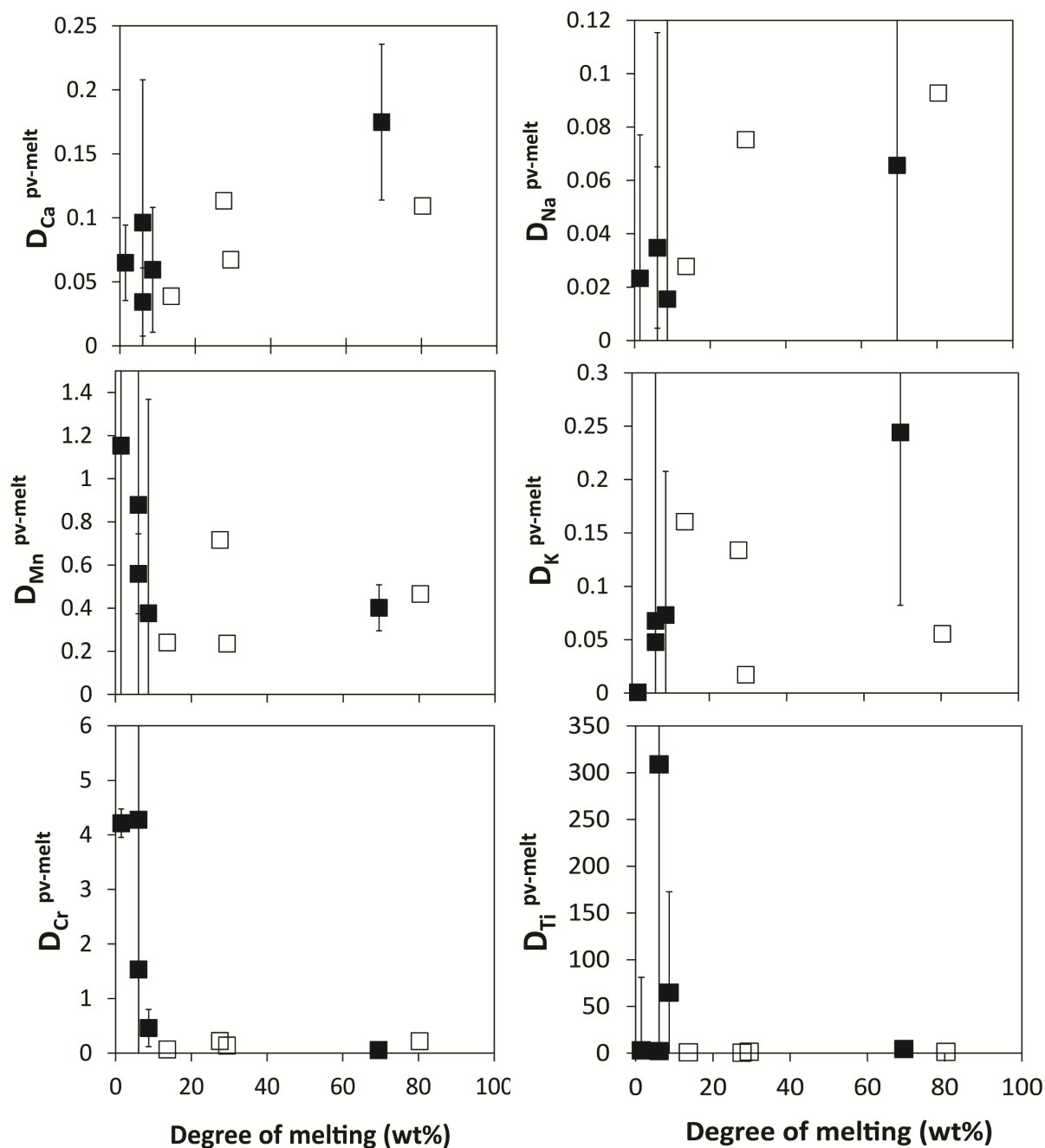
Supplementary Material



Supplementary Figure 1 Typical temperature profile for our experiments (here run #104). The rapid quench after the first heating above the liquidus induces crystallization of a first Bg phase, which happens to be relatively depleted in Fe. A second Bg phase, relatively enriched in Fe, crystallizes on the plateau, due to a slight temperature decrease with time at constant electrical power.



Supplementary Figure 2 Example of fitting of a XANES pre-edge spectrum of our bridgmanite sample. The baseline is obtained by modeling the low energy side of the edge as a Voigt peak. Two components with a 50:50 Lorentz/Gaussian peak shape and a fixed width of 1.65 eV are fitted for the pre-edge. The lower curve shows the residual of the fitting procedure.



Supplementary Figure 3 Change of the Ca, Na, Mn, K, Cr and Ti partition coefficients between Bg and melt with the degree of partial melting. Full and open squares show partitioning coefficients derived from the composition of Fe-poor (Bg1) and Fe-rich (Bg2) Bg phases, respectively. The coexisting melts are those observed in the sample directly (filled squares), or a reconstruction based on the phases that recrystallized from the primary liquid upon cooling (open squares) (see [Supplementary Figure 1](#) and text for more details). Major features are: (1) the incompatibility of Ca, Na and K in Bg, (2) the very similar behavior of Mn and Fe and (3) the compatibility then incompatibility of Cr at $F < 7$ and above this F -value respectively.