Phase diagram and melting of NiSi up to 115 GPa

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In this contribution we present detailed results on the melting curve and multiple phase boundaries in the NiSi binary system up to 115 GPa and more than 3500 K. Studying binary metal-silicon alloys is important for the interpretation of the Earth's core physical properties. Indeed, silicon might be one of the light elements which has been proposed to explain the density deficite of the Earth's core while nickel is ~6% one of its main consitituents.

Recently, studies on FeSi as well as on NiSi have revealed a complex phase diagram of these binary systems and well reported melting curves up to 70 GPa. We have studied the NiSi system up to the conditions relevant for the bottom of the Earth's mantle (115 GPa, > 3500 K) using laser-heated diamond anvil cell techniques coupled with energy-dispersive X-ray absorption spectroscopy. By conducting series of finely meshed P/T data points we could constrain in detail the solid-solid phase boundaries as well as the solid-liquid transition.

This approach allowed us to reveal distinct changes in the XANES spectra appearing just below the melting curve and in an region previously unexplored (70-115 GPa). These changes might be attributed to a new metastable phase at temperatures above 2500 K. In addition, we found new diffraction peaks in pressurized samples at 110 GPa that were quenched form laser-heating beyond 3500 K. The extrapolated melting line from 115 GPa to outer core conditions is used to discuss the Earth's core light element nature.