Abstract No. Chen0055

Density of FeS at High Pressure

J. Chen, D. Weidner and M. Vaughan (SUNY, Stony Brook)

Beamline(s): X17B1

Introduction: Physical properties (e.g. density and elasticity) of minerals, combined with geophysical evidence (e.g. seismology and gravitational observations), are very important for understanding a planet's structure. While density measurements of crystalline minerals at high pressure and temperature can be routinely carried out using in-situ diffraction techniques, experiments to determine density of melts at static high pressure are rare[1, 2]. Experimental technique has hindered us from studying equation of state (EOS) of molten minerals, which is essential for understanding earth especially earth's core. Iron is believed to be the principal constituent of terrestrial planets' cores, but some light elements are required to match densities of the cores extracted from gravimetric and/or seismic (for Earth) data to the experimental data of candidate materials[3]. Sulfur is a very important candidate for the light element in the Earth's core and the Martian core[4-7].

Methods and Materials: Density measurements of noncrystalline sample are conducted by using newly developed x-ray radiograph technique[8] with the large-volume press SAM85 and monochromatic x-ray at X17B1. Powdered crystalline FeS sample is as starting material. Sample are compressed to 4 GPa and then heated up to its melting temperature (1300°C).

Results: Figure 1 shows the densities derived from radiograph and x-ray diffraction before the sample melts. A density drop is observed at 1300°C indicating melting of the sample. Loss of crystalline diffraction peaks in the x-ray diffraction pattern confirms the melting. The measured density before melting is consistent with the previous x-ray diffraction study by Fei et. al.[9] This density measurement technique has a great potential in EOS studies of molten minerals because of the short measurement time.

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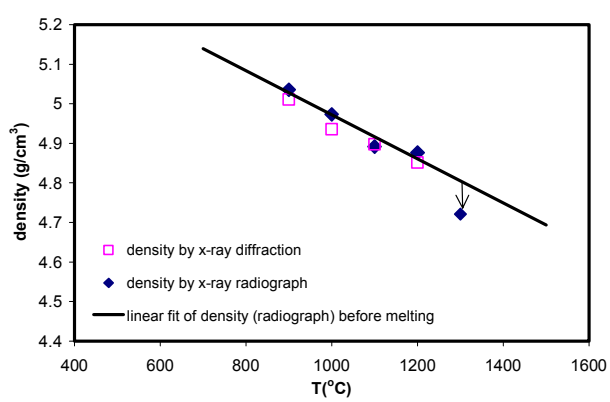

Figure 1. Density of FeS as a function of temperature at 4 GPa.