In-situ x-ray, high pressure, high temperatures studies of spinels in a large volume press.

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Many spinels show phase transformations under pressure (Fei 1995 [1], Levy et al. 2000 [2]) and are used as model structures for deep earth mineralogy and for a better understanding of underlying high-pressure phase transition mechanisms. It is widely accepted that the behavior within the transition zone of the Earths' interior (410-670 km depth) is strongly linked to the properties of minerals showing spinel or pseudospinel structure.

The temperature and pressure dependent volume change were Spinels seem to be important constituents of the deep interior of the Earth while transition with spinel or pseudospinel structure strongly influence the dynamic of the mantle. On the other hand, spinels are widely used as artificial material.

The experiments were carried out at DESY German Electron Synchrotron (Hamburg, Germany) on two beamlines (F2.1, W2) at DORIS III ring, with a single stage and a double stage multi-anvil press, respectively. XRD-Spectra at both presses were collected using energy-dispersive mode. The high pressure multi anvil devices MAX80 (F2.1 Beamline) and MAX200x (W2 Beamline) were used to determine the pressure and temperature induced volume change.

The F2.1 beamline was a bending magnet beamline with a critical energy of 16.6 keV and an energy range up to 75 keV. The W2 beamline was a hard-wiggler beamline with a critical energy of 26.4 keV and an energy range up to 150 keV. Energy-dispersive X-ray diffraction was used to determine the pressure and temperature induced volume change. Isothermal experiments were performed up to 15 GPa at ambient temperature.

[1] Fei, Y. (1995) Thermal Expansion. In: Ahrens, T. J. (Publisher): Mineral Physics & Crystallography: A Handbook of Physical Constants, pp 29–44. American Geophysical Union, Washington.

[2] Levy, D., Pavese, A., and Hanfland, M. (2000) Phase transition of synthetic zinc ferrite spinel (ZnFe2O4) at high pressure, from synchrotron X-ray powder diffraction. Physics and Chemistry of Minerals, 27, 638–644.