| ESRF | Experiment title: **Phase Relations, Structure and Elastic Properties of $FeO_{.940}$ at Earth 's Mantle Conditions** | **Experiment number: HS 189** |
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The geochemical and geophysical consensus on the chemical composition of the Earth is that it is a layered body with a dominantly iron core and a silicate mantle. There are at least two areas in the field of high pressure research which are significantly affecting our perception on the chemical composition of the interior. These are: a) phase transitions and reactions in silicates and oxides (in the Earth's mantle) and b) phase transition and melting of iron (in the Earth's core).

Wuestite is considered an important constituent of the lower mantle. It forms a solid solution, magnesiowustite, with MgO, which coexists with perovskite $(Mg,Fe)SiO_3$ or silica phases. We heated wuestite ($FeO_{0.94}$) electrically in a diamond-anvil cell between pressures of 5 and 83 GPa and temperatures up to 1500K and performed *in-situ* XRD measurements, using SR (ESRF) and $MoK\alpha$ (rotating anode generator at Uppsala) radiation in angle-dispersive mode (IP at ESRF, CCD area detector at Uppsala). The results show that the end member component of this series, wuestite, has at least two distinct phase transitions: cubic (NiAs; Bl) to rhombohedral at pressures higher than 15GPa (in Ar pressure medium), rhombohedral to (assumedly) monoclinic at pressures above 40 GPa (quasihydrostatic conditions; Ar pressure)

We observed direct and reversible transitions between monoclinic and cubic phases at high temperature. The mcl phase is stable over a high range of pressure and temperature. From independent studies of the elastic properties of wuestite as a fct of p and T, we inferred that the driving forces of both B l-rhombohedral and rhombohedral-monoclinic transitions is softening of C44 ; both transitions could be described as second-order transitions.

Several new experiments conducted at close to melting indicate that wuestite dissociates at high pressure to iron and magnetite which itself undergoes phase transition. At ESRF we did several new experiments at high pressure (> 6.5 GPa) and high temperature (>1500 K) and find that NiAs may not be stable at high temperature.

We must continue with experiments on heating and determining the perovskite and Fe0 transitions and dissociations. We will use both C02-laser and Nd-YAG lasers and electric heating and follow the procedures amply discussed here and elsewhere in many publications.