ESRF	Experiment title: High-pressure deformations mechanisms and rheology of serpentine +olivine aggregates using synchrotron X-Ray diffraction and imaging	Experiment number: ES-201
Beamline: ID06LVP	Date of experiment: from: 26 <sup>th</sup> nov. 2014 to: 2/12/2014	<b>Date of report</b> : 28/08/2015
Shifts: 18	Local contact(s): Jérémy Guignard	Received at ESRF:

Names and affiliations of applicants (\* indicates experimentalists):

Dr Nadege Hilairet CNRS – Université of Lille \*

Pr Sebastien Merkel – University of Lille \*

Dr Paul Raterron – CNRS - University of Lille \*

PhD students:

Thomas Ferrand - Ecole Normale Supérieure \*

Christopher Langrand - University of Lille \*

## Report:

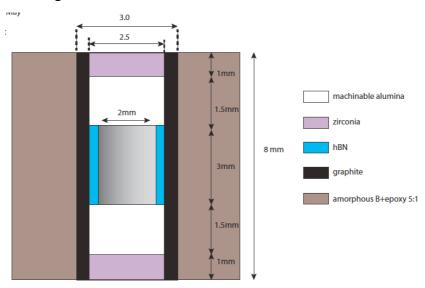
Experiment ES201 was aimed measuring the rheology at high pressure of serpentinized peridotite, a rock relevant to subduction zones dynamics. The mineral serpentine has a mechanical weakening effect on peridotite, and the goal was to quantify the effect of the serpentine amount on the bulk rheology and deformation mechanisms in the rock. We carried out in-situ deformation runs on the large volume press on ID06 at low bulk sample strains on natural peridotite during ES82, in nov. 2013. The present projet ES-201 was dedicated to synthetic peridotites, where the homogeneity and the serpentine content of the samples are much better controlled. We realized a series of experiment with composition varied between 5 and 50%.

## Technical aspects and progress

The points listed in the report for ES-82 had been adressed when we started, except for the automated switching between diffraction and imaging. The samples were imaged by taking a series of e.g. 10 radiographs (ca. 0.5 mm height beam) over the whole experimental column (about 5 mm including pistons) and the images were concatenated using a Fig2D macro. The diffractions were taken using a linear detector with rotation centered on the direct beam. Typically a diffraction can take a minute.

Due to some changes in the experimental setup, the high pressure cell could be modified to a more usual design with a vertical furnace and connections to the power supply through top and bottom of the cube (Fig 1). This lead to a much more stable cell from a mechanical point of view.

Fig. 1: Experimental cell design



## **Experiments:**

The successful experiments are listed below:

Run	Load (bar)	Power (W)	<b>Composition (volume %)</b>
Serp_06	30	78	atg5:Ol95
Serp_07	30	80	atg10:Ol90
serp_08	30	82	atg20:Ol80
serp_09	30	75	atg20:Ol80
serp_10	30	77	atg50:Ol50

The sample space was divided in two: a half height was San Carlos olivine and the other half was the sample. The samples were all pressurized to the same load, heated around 400°C and deformed using a speed similar to what was used in ES-82.

Fig. 2 shows strain results for runs Serp\_06 and Serp\_10. While a 5% antigorite – 95% SC olivine synthetic peridotite deforms at the same rate approximately as pure SC olivine, the 50% antigorite – 50% SC olivine deforms much faster than pure SC olivine and than the 5:95 composition.

Fig. 2 –strain results for two successful runs.

