ESRF	**Experiment title:** High pressure x-ray investigation of dislocations in post-perovskite phases	**Experiment number**: HS-3279
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Report:

The goal of the experiment was to investigate the nature of dislocations that can develop in post-perovskite phases plastically deformed, in-situ, under the pressures of the Earth mantle using micro-diffraction and peak broadening analysis techniques. To do so, individual grains have to be found in the diffraction pattern, and for each peak corresponding to those individual grains, we need to obtain a high resolution diffraction pattern for peak profile analysis.

Upon arrival, we had two samples of $MgGeO_3$ in the post-perovskite phase, loaded in diamond anvil cells. The first sample had been prepared from $MgGeO_3$ orthopyroxene, mixed with amorphous boron, and converted to the post-perovskite phase by in-situ laser heating at 86 GPa. The second sample had been prepared from $MgGeO_3$ orthopyroxene, mixed with platinum powder, and converted to the post-perovskite phase by in-situ laser heating at 71 GPa. Both samples had a diameter of 130 microns with an unknown grain size.

The cell was mounted on a single axis goniometer for ω turning. The high resolution CCD coupled detector was used in a close (150 mm) and a far (600 mm) distance from the specimen.

In the close detector position, the diffraction patterns were recorded in steps of $\Delta\omega = 0.25$ deg. with 2s counting period over a range of 80 to 101 degrees one side of the sample and -99 to -74 degrees on the other side. These measurements were then used to determine the orientation matrices of the scattering grains. Upon pre-processing, it was noticed that the grain size in the first sample was too small to be analysed. It was therefore removed from the stage and we then focused on the second sample only. For the second sample, preliminary analysis indicates that individual grains can indeed

be observed within the polycrystal in the diamond anvil cell, with cell parameters matching those deduced in Rietveld analysis.

The detector was then moved in the far position. In the far mode, we recored partterns with the detector in a 3x3 matrix position. For each detector position, we recorded patterns with the cell covering the same ω range than in the close detector mode, in multiple times in order to increase counting statistics.

For the second sample, data was collected right after the phase transformation and after inducing plastic deformation on the sample, which was visible from the broadening of the x-ray peaks. During the course of the experiment, we acquired thousands of diffraction patterns, including 1000 images for calibration, 600 images for the second sample with the detector in a close position, and 3500 images for the second sample with the detector in a far position.

A typical image obtained for tor the close detector position is shown in Figure 1. It is then processed for background and powder pattern filtering. Individual peaks are then extracted and can be processed for determining the orientation matrix of the scattering grains (Figure 2). At present, we are extracting those matrices and developping sofware to correlate the images obtained in the close and far detector positions. Once we will have the orientation matrices for some of the grains along with the positions of the peaks on the far detectors, we will be able to locate them and perform the line broadening analysis.

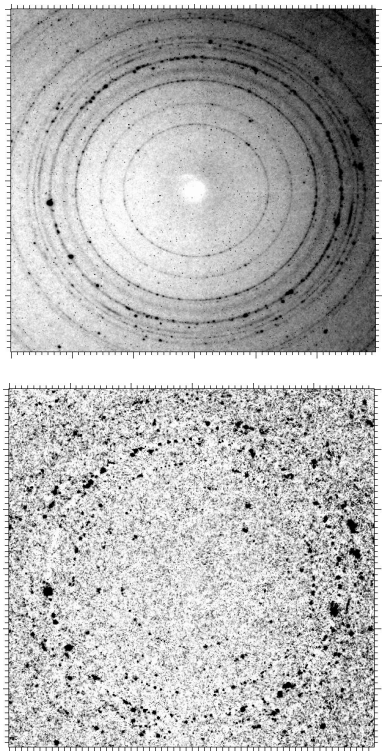

Figure 1: Typical diffraction image in close detector position. Upper image was obtained for one ω value. Lower image was obtained from the upper one after background and powder pattern filtering. It is ready for single-peak processing.

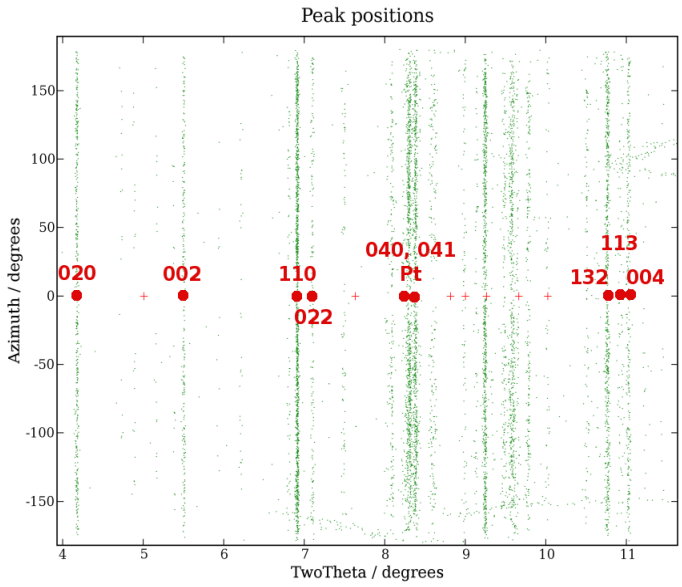

Figure 2: Subset of 12000 individual peaks extracted from 90 images with the detector in close position. These are used for determining the orientation matrix of the scattering grains. Preliminary peak assignment for $MgGeO_3$-pPv is shown on the figure.