EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal:

https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Reports supporting requests for additional beam time

Reports can be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Direct observation of atomic-scale shear band dynamics in metallic glasses	**Experiment number**: HC-3749
Beamline:	**Date of experiment**: from: 19 july 2018 to: 24 july 2018	**Date of report**: 8/09/2020
Shifts:	**Local contact(s)**: Yuriy Chushkin, Federico Zontone	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

We measured samples of metallic glass Pd40Ni40P20 with different preannealing and mechanical deformation states. The main aim of the experiment was to unveil the differences in microscopic dynamics between the different states. Some results have been published in

X-ray photon correlation spectroscopy revealing the change of relaxation dynamics of a severely deformed Pd-based bulk metallic glass | Zhou H., Hilke S., Pineda E., Peterlechner M., Chushkin Y., Shanmugam S., Wilde G. | Acta Materialia, vol.195, p.446-453, 2020.

Preliminary results after a first analysis of the data:
1st sample (ann_ascast): Pd40Ni40P20 rod of 5mm diameter. After casting it was annealed at 250C during 6h. A disk was polished until approx. 40 microns thickness. The disks were cut in four pieces. One piece was introduced in the sample holder for XPCS. Figure 1 shows and example of the change in dynamics at 150C and 200C.

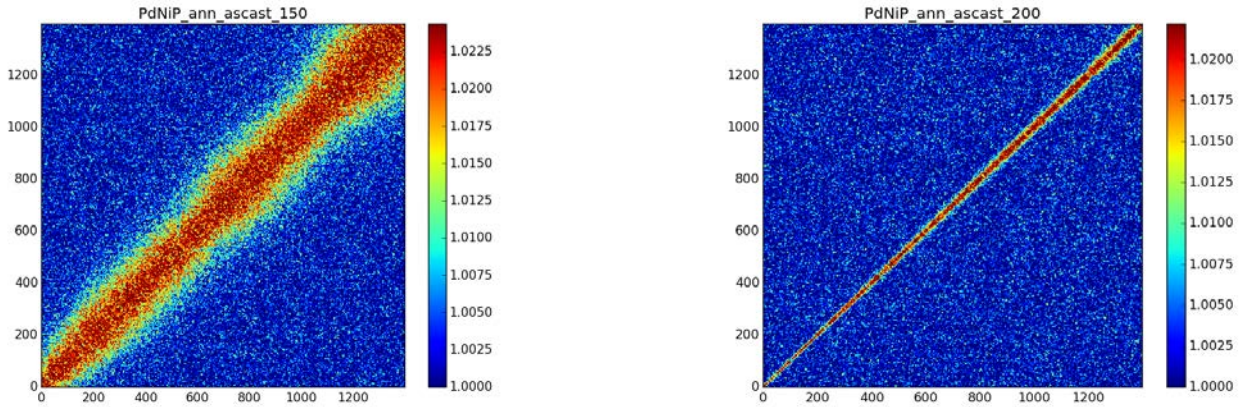

Figure 1

The g2 functions were calculated and analysed in terms of temperature and waiting time for all te samples measured. For the first sample we show below the obtained g2 functions (Figure 2) and the evolution of the relaxation time (Figure 3).

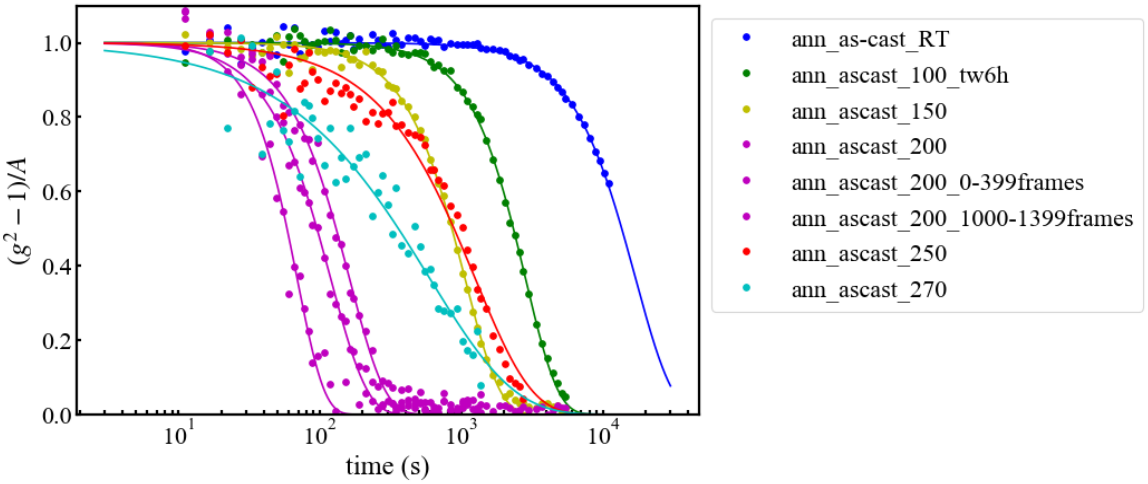

Figure 2

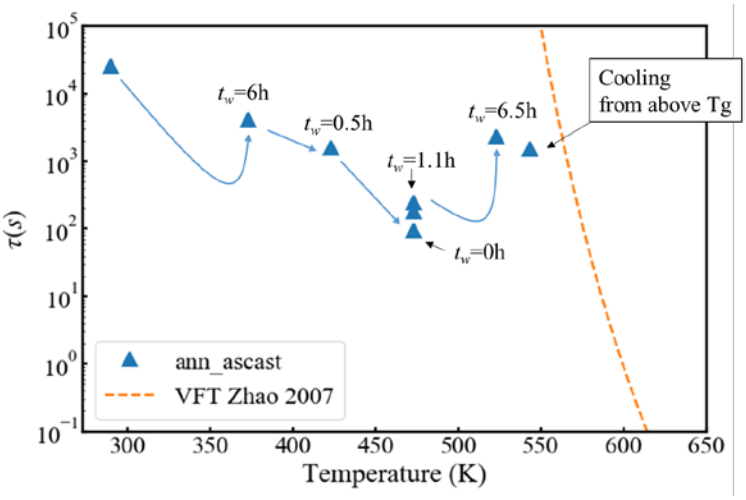

Figure 3

A similar study was performed for the following samples. **2nd sample (ann_100HPT):** Pd40Ni40P20 rod of 5mm diameter. After casting it was annealed at 250C during 6h. After annealing the sample was deformed by high-pressure torsion for 100 revolutions. Approx. 40 microns thickness. **3rd sample (ann_3HPT):** Pd40Ni40P20 rod of 5mm diameter. After casting it was annealed at 250C during 6h. After annealing the sample was deformed by high-pressure torsion for just 3 revolutions. Approx. 40 microns thickness. **4th sample:** Pd40Ni40P20 rod of 5mm diameter. After casting it was annealed at 250C during 6h. After annealing the sample was deformed by high-pressure torsion for 10 revolutions. Approx. 40 microns thickness. For this sample only room temperature was measured. **5th sample (asquenched):** Pd40Ni40P20 rod of 5mm diameter as-quenched. Approx. 40 microns thickness. Same protocol of sample 2 and 3 but only 200C can be reached before finishing the experiment.

Figure 4 compares the relaxation times observed for the different samples, indicating a clear rejuvenation effect in the deformed samples. A more fine analysis is currently being performed in order to determine if the deformation introduces changes in the shape of the decay of the correlation functions or the aging response in comparison with the states obtained by rapid quenching.

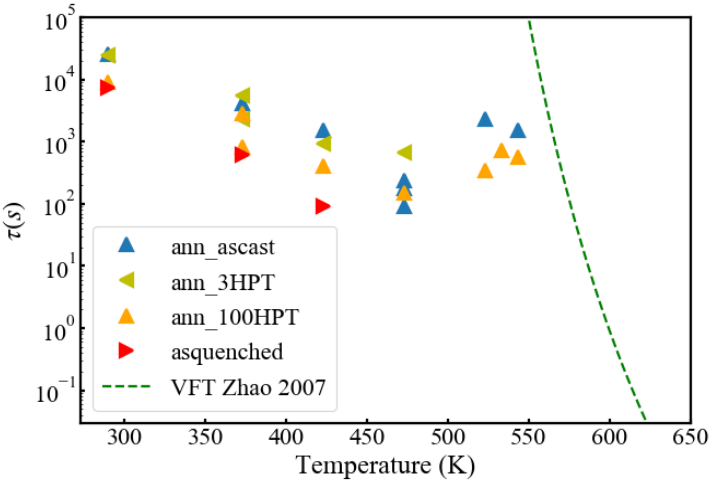

Figure 4

Due to some experimental problems during the first two days we could not follow long isotherms at high temperatures, as we decided that was better to see the differences between samples of different deformation and we had then no time for applying long protocols to various samples. It would be interesting to follow the aging by XPCS at certain temperatures and see the influence of deformation state in to the aging path and the final state reached in a new proposal.