ESRF	**Experiment title:** Reactivity of xenon with iron under ultra-high pressure	**Experiment number**: CH-4706
Beamline: ID27	**Date of experiment**: from: 13/06/2016 to: 16/06/2016	**Date of report**: 20/02/2017
Shifts: 6	**Local contact(s)**: V. Svitlyk	*Received at ESRF:*

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Report:

The aim of the experiment was to observe experimentally possible reactions between xenon and iron around 200 GPa. Such reactions have been predicted by density-functional theory based structure search methods [1]. Two runs have been performed (see **Table 1**). For each run, a metallic foil of either Fe has been loaded with Xenon as pressure transmitting medium. The foil was insulated from the diamond anvil with a thin KCl layer.

Name	culet diameter (μm)	Heating P (GPa)
XeFe4	70	140
XeFe5	70	180-210

Table 1: Conditions of the six experimental runs.

In our previous measurements, an unefficient heating of the sample was observed. In order to solve this problem, a thicker layer of KCl and a thinner samples were loaded here. Unfortunately, in run FeXe4, the Fe sample signal was too weak. In run FeXe5, the signal was more intense. The sample has been compressed to a pressure around 180 GPa. It has been laser heated and if no reaction was detected, the pressure was increased by ~5-10 GPa GPa steps and laser heated. The pressure was measured using the equations of states of the reactants [2,3,4]. The temperature has not been measured during heating; visual observation of the samples during laser-heating suggests that the surface temperature was higher than 3000K. We have compressed the sample up to the maximum pressure reachable with these cells, around 210 GPa, without observing any reaction. The reaction was predicted around 190 GPa [1]. It is possible that it actually happens at a pressure higher than the pressure that we have reached.

These observations have been published in the following article: A. Dewaele, C. M. Pépin, G. Geneste and G. Garbarino, “Reaction between nickel or iron and xenon under high pressure”, High Press. Res. 20/12/2016.

References:

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[3] Dewaele, M. Torrent, P. Loubeyre and M. Mezouar, “Compression curves of transition metals in the Mbar range: Experiments and projector augmented-wave calculations”. Phys. Rev. B 78, 104102, 1-13, 2008
[4] A. Dewaele, P. Loubeyre, P. Dumas and M. Mezouar , “Oxygen impurities reduce the metallization pressure of xenon”, Phys. Rev. B 86, 014103, 1-5, 2012