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| | **Experiment title:**<br>New chemistry of Xe at extreme conditions. | **Experiment number**:<br>**CH3003** |
| **Beamline**:<br>ID27 | **Date of experiment**:<br>from: Nov.26 2009 to: Dec.1 2009 | **Date of report**:<br>05/08/2010 |
| **Shifts:**<br>15 | **Local contact(s)**:<br>M. Mezouar | *Received at ESRF:* |

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## Report:

Xe is among the gases that stabilize clathrate hydrates structure I through van der Waals interactions. Xe hydrates are stable up to 2.5 GPa, before dissociating into Xe plus ice VII[1]. However, the chemistry of water with solid Xe has been successfully explored by UV photolysis. Among the obtained compounds are $HXeOH$[2] and $HXeOXeOH$[3], the latest synthesized to date, which result from the insertion of Xe atoms in the water molecule. One HXeOXeH molecule computationally accumulates a very high energy of 8.3 eV as compared to the global $2Xe + H_2O$ minimum. Probably, it is a recordbreaking value for high-energy materials[4]. Those findings plus our own results on the stability of Xe oxides in the terrestrial crust[5] let us envisage that the chemistry of Xe with oxygen at extreme conditions could be flourishing. Water is besides an important component of terrestrial and giant planets so that any reactivity with Xe at depth would have strong consequences on our knowledge of planetary dynamics as it heavily relies on Xe isotopes geochemistry.

During this experiment, the reactivity of Xe with water has been explored using a laser-heated diamond-anvil cell. Water was loaded in a rhenium gasket along with a Pt foil to serve as a laser absorber, Xe added cryogenically. The X-ray diffraction patterns abruptly changed upon heating at 50 GPa (see Fig.1), with new peaks growing at the expense of Xe diffraction peaks. These new peaks remained upon cutting the power of the lasers. We are now in the phase of indexing these peaks and deciphering the products of the reaction.

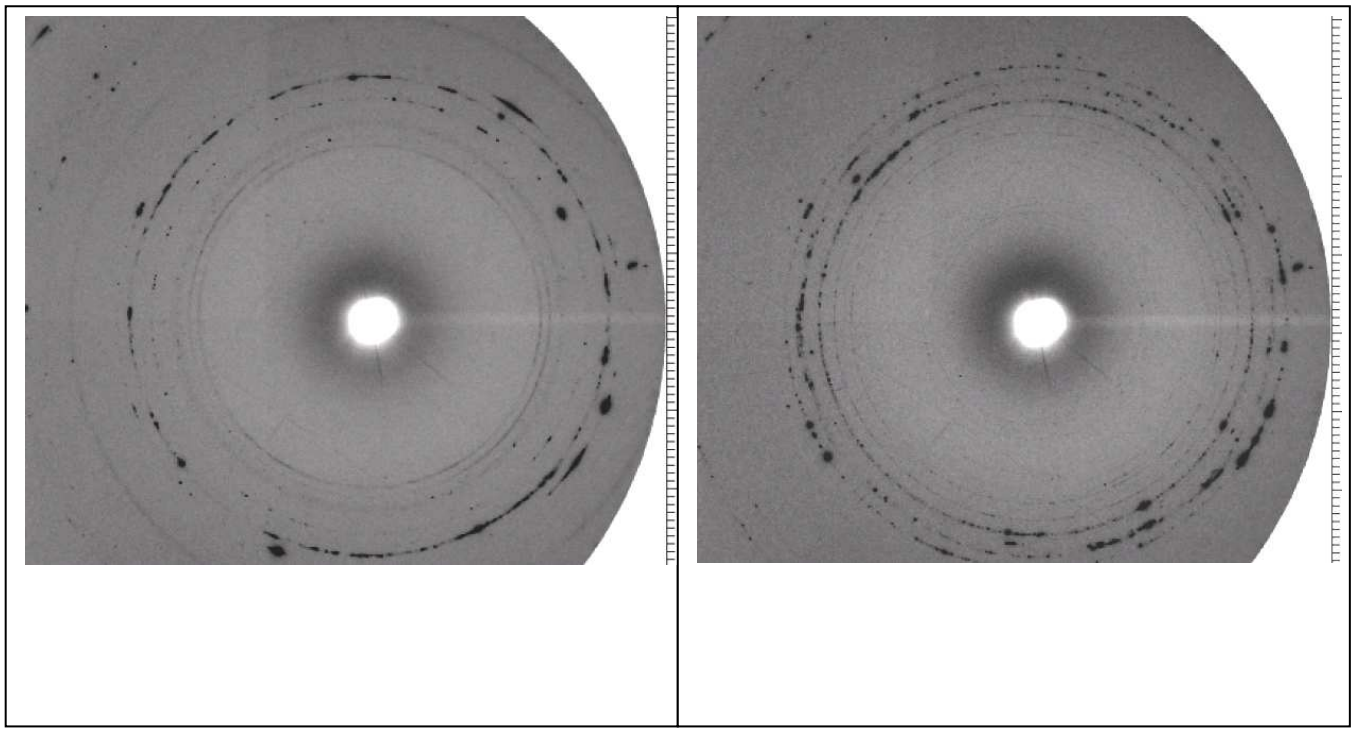

Fig.1: Images plates recorded before (right) and after (left) the reaction.

**References:**

[1]C. Sanloup et al., PNAS 99, 25 (2002).
[2]M. Pettersson et al., Eur. J. Inorg. Chem. 505, 729 (1999).
[3]L. Khriachtchev et al., JACS 130, 6114 (2008).
[4]W. Grochala, Chem. Soc. Rev. 1632, 36 (2007).
[5]C. Sanloup et al., Science, 310, 1174 (2005).