ESRF	**Experiment title:** Energy and Topology dependence of the metamict transformation in glasses	**Experiment number**: HC5295
Beamline: ID10	**Date of experiment**: from: 20/06/2023 to: 26/06/2023	**Date of report**: 21/09/2023
Shifts: 18	**Local contact(s)**: Federico Zontone	*Received at ESRF:*

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Report:

The experiment was devoted to the investigation of the energy dependence of the dynamics induced by brilliant and coherent X-rays on a set of oxide glasses. To the best of our knowledge, there were no data on how this effect relates to the different energy of the incoming X-ray beam. This investigation has given an additional hint on the features of the beam induced phenomenon, the artificial effect pumped by intense X-ray beams.

The properties of the upgraded ID10 beamline have been crucial to probe this dynamics, thanks to its coherent properties and high brilliance in a wide energy range.

Originally we wanted to use four oxide glasses: SiO_2, B_2O_3, GeO_2 and P_2O_5. Unfortunatly, we were not able to synthetize the P_2O_5 glass for its high reactivity to water, a feature that make it very difficult to prepare in the needed shape and thickness. For this reason we studied the three other glasses.

The setup was a standard X-ray Photon Correlation Setup in wide angle configuration. We used three different energies to probe the dynamics. In the table below we have listed the different setup specifications for every energy.

Energy (keV)	Photon flux (ph/s)	Spot Size (μm^2)
8.67	2.0x10^12	7x5
15.875	9.4x10^11	7.1x3.7
21.67	8.3x10^11	5.2x4.4

Table 1. Setup specification for every energy.

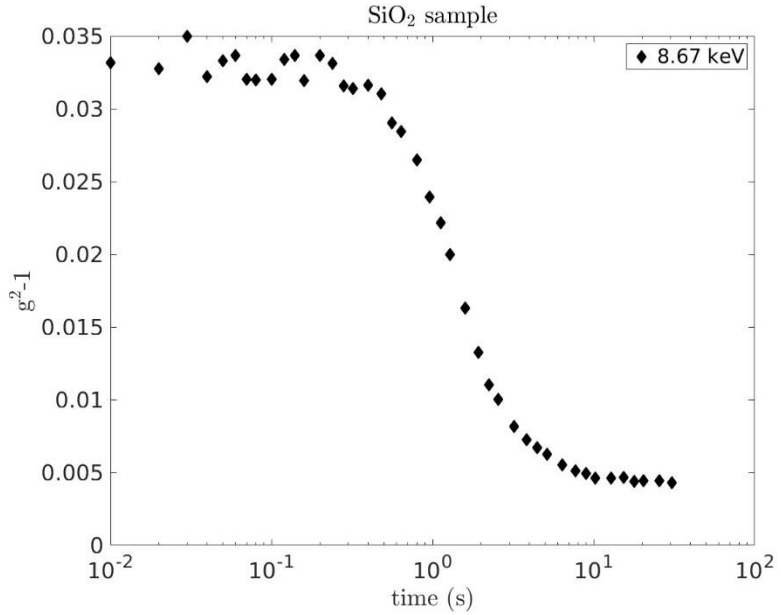

Figure 1XPCS correlation curve for SiO_2 sample at 8.67 keV. The contrast is 3% as the one found with 21.67 keV energy

At every energy we fixed the angular position of the 2D detector (EigerX4M, dectris) in order to look the dynamics at interatomic distances. Also, we changed the sample at every energy because we wanted to be sure to be on a fresh point for every measurement. Consequently, we had three samples for every type of oxide glass cited before.

During the measurement the samples were kept in a kapton cup under vacuum in order to avoid sample degradation, a necessary precaution for the GeO_2 and B_2O_3 glasses.

We started the experiment probing the SiO_2 sample at 21.67 keV and the detector fixed at 8 degrees. We got a good signal to noise ratio with an XPCS contrast of 3%. The measure on B_2O_3 and GeO_2 have required longer integration times because the samples were thicker and the contrast was around 1.5%.

Afterwards, we changed the energy to 15.875 keV. Here the correlation curves are noisier because the setup is not optimized at this energy. In any case, we afforded to collect correlation curves for every sample. The best curves have been acquired by using the 8.67 keV energy beam because the beamline is optimized for this energy.

In general we got an extremely high beam stability during all the experiment, even after three changes in energies. We are satisfied of the recent improvement in stability and flux of the ID10 beamline.

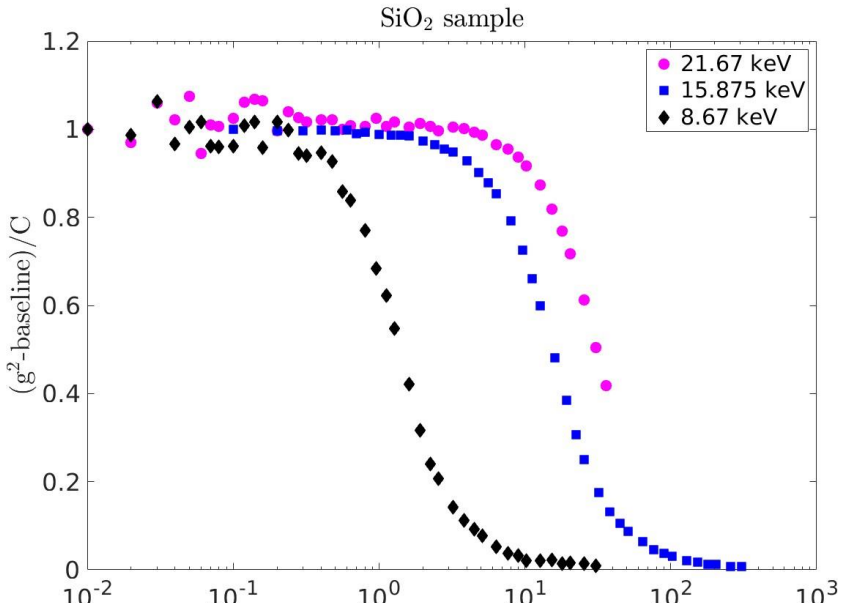

Figure 2XPCS correlation curve for the SiO2 sample at three different energies. The increase in the energy of the x/ray beam induces a deceleration in the artificial dynamics

During the experiment we have collected several milions of images, so the analysis is still ongoing. This data will be crucial in making a further step in the knowledge of the beam induced phenomenon and we plan to publich the results on a high impact journal, becuse of the relevance of the phenomenon to a wide class of measurements.