Experimental Report

Proposal: **6-05-890** **Council:** 10/2011

Title: Intermediate range-order in disordered aluminates

This proposal is a new proposal

Researh Area: Materials

Main proposer: **CRISTIGLIO Viviana**

Experimental Team: ZANGHI DIDIER
HENNET Louis

Local Contact: CRISTIGLIO Viviana

Samples: YAlO3
Y2O3 Al2O3
CaAl2O4 + SiO2 (0-10%-30%)
Y3Al5O12
Y4Al2O9

Instrument	Req. Days	All. Days	From	To
D16	7	4	03/12/2012	07/12/2012

Abstract:

Most of the experimental techniques that are available for studying liquid and glass structure are mainly successful in answering questions related to short-range order, but not many works of the structure at the intermediate range order of these systems has been done.
The aim of this proposal is to continue the study of the structural evolution at intermediate distances of calcium aluminosilicate glasses (CaAl2O4)1-x-(SiO2)x (CAS) and of the Y2O3-Al2O3 system, started in a previous work (exp.: 6-03-323). These studies will be performed at different CaO, SiO2 and Y2O3 contents respectively and as a function of temperature.
This study will permit to investigate the temperature-dependent phenomena in the corresponding liquids prior to quenching and the influence of the network modifiers channels, all of which involve changes in the intermediate-range structure.

The aim of this proposal is to continue the study of the structural evolution at intermediate distances of calcium aluminosilicate glasses (CaAl2O4)1-x-(SiO2)x (CAS) and of the Y2O3-Al2O3 system, started in a previous work (exp.: 6-03-323) using aerodynamic levitation combined with laser heating.). These studies will be performed at different CaO, SiO2 and Y2O3 contents respectively and as a function of temperature. All these systems have already been studied using x-rays and neutron classical diffraction. With D16 measurements we will be able to study structure of high-temperature liquids and glasses at the intermediate range order. By combining the results obtained with the two techniques, it will be possible to obtain a reliable representation of the structure (coordination numbers, distances) as a function of the temperature, taking advantage of the different scattering factors for neutron and x-rays.

A new chamber in pure aluminum for the aerodynamic levitation combined with laser heating will be designed for these D16 measurements (Fig 1) in order to reduce noise from the background. Larger nozzles will be fabricated to work with bigger samples (up to 5mm in diameters).

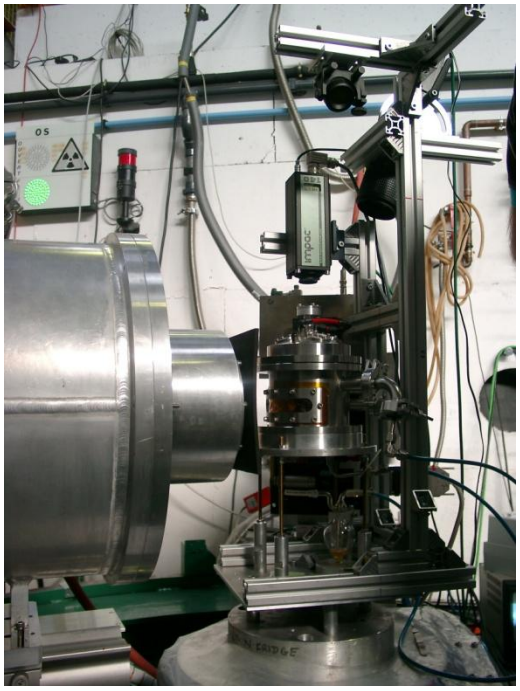

Fig. 1 New Al chamber for the aerodynamic levitation installed on D16.

We study the intermediate range order and the network formation of the CAS compound from the liquid at various temperatures below the melting point to the glass state centering our attention in particular in the Q region between 0.1 to 2 Å-1.

For liquids it was not possible to extract exploitable data because the background contribution was too high compared by the signal of from the sample and it was not possible to correct it in the data treatment.

For glasses we obtain very good results and we see the change of the cation-cation correlation in a function of concentration (Fig. 2).

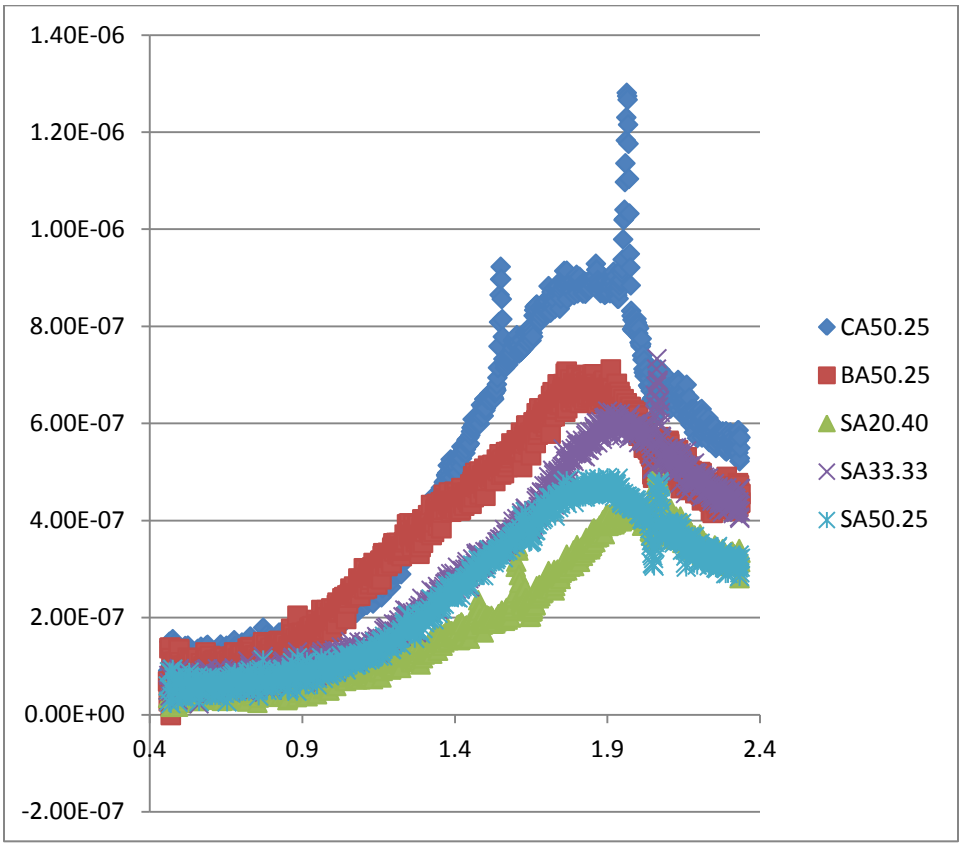

Fig.2

These glasses were created by means the levitation device itself. Once in liquid phase the lasers are stopped and instantaneously the sample cool down reaching the glass phase. In same case the glass was partially crystallized as we see in the figure 2.