

**Experiment title:**

Searching the link between luminescent properties of Ag ions in soda-lime glass and the local structure: an X-ray Absorption Spectroscopy study

**Experiment number:**

HE 378

**Beamline:**

GILDA

**Date of experiment:**

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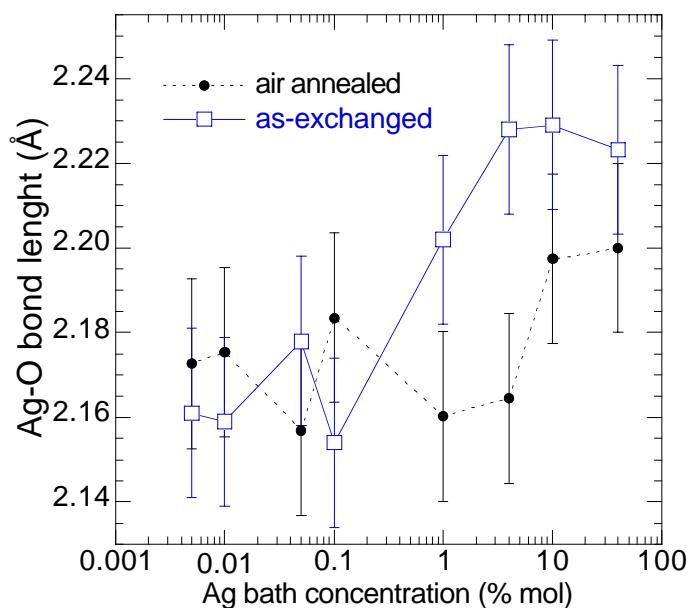
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**Local contact(s):** F. d'Acapito*Received at ESRF:***Names and affiliations of applicants** (\* indicates experimentalists):

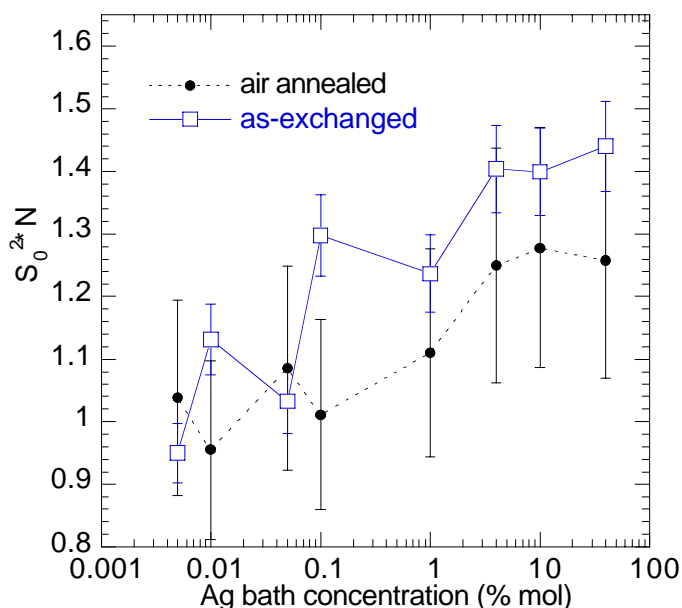
F. Gonella\*, E.Borsella, E.Cattaruzza\*, C.Maurizio\* Univ. di Padova - Dip. di Fisica Via Marzolo 8 35131 Padova (Italia)

F.d'Acapito\* I.N.F.M.c/o ESRF GILDA CRG BP220 F-38043 Grenoble (France)

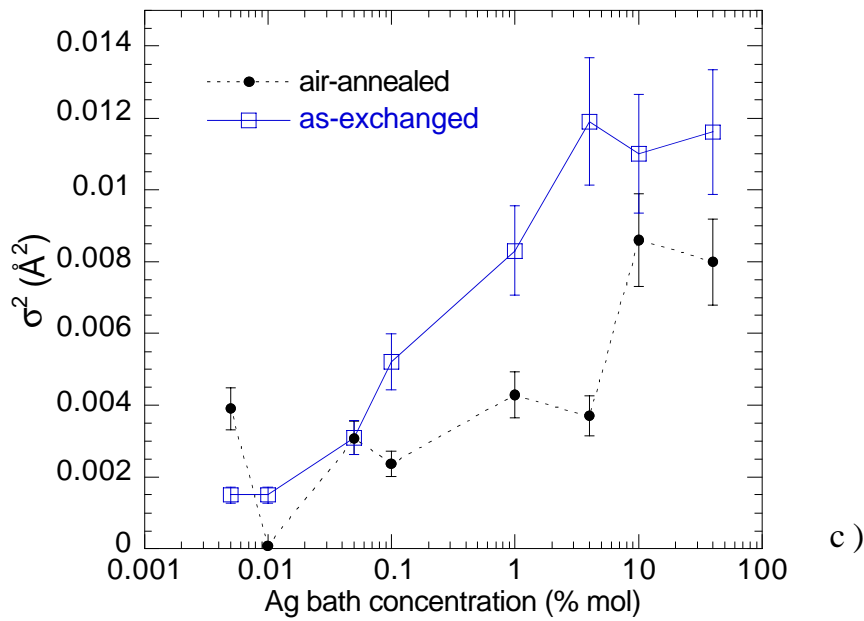
Ag-doped soda-lime glasses exhibit various optical luminescence properties depending on the Ag content in the matrix [1]. This behaviour is ascribed [1] to a change of the Ag local atomic order with the glass composition. The aim of this experiment was to directly determine the local atomic order around Ag ions in soda-lime glasses at different concentration values by Extended X-ray Absorption Spectroscopy (EXAFS) at the Ag k edge (25514 eV). A serie of samples obtained by the ion-exchange process at different concentrations (40-> 0.01 mol %) of AgNO<sub>3</sub> in the molten salt bath was successfully investigated in the present experiment. The most concentrated samples were studied in transmission mode, the others (<1 mol%) in fluorescence mode. In the figure, results of EXAFS analysis are reported. For all the examined samples, only Ag-O coordination was found. A dependence of Ag local environment on Ag concentration in the bath is evident.



a)



b)



Rather surprisingly, increasing Ag concentration ion bath determines a progressive increasing of Ag-O bond length (Fig. 1a); nearest neighbour number (Fig. 1b) and mean square relative displacement (Fig. 1c) are also increased. This suggests that even at relatively low concentration values, such that no silver-silver coordination may be found, the glass structure undergoes a rearrangement that depends in a complex way on the silver atoms dispersed in the matrix. When samples are heat-treated, the structure is further rearranged, and the behavior observed for as-exchanged samples is much less evident. In general, these findings indicate that silver-alkali replacement gives rise to a re-configuration of the local order around the dopant, pointing out that the binary exchange process cannot be described as a simple substitution. These results are an effective starting point for the development of a model of ion-exchanged process, which is presently in progress [2].

[1] E. Borsella et al., Appl. Phys. A 71 (2000) 125.

[2] G. Battaglin et al., Nucl. Instrum. Meth. B 166-167 (2000) 704.