ESRF	**Experiment title:** Structural study of undercooled liquid metallic alloys using aerodynamic levitation and RF heating	**Experiment number**: MI 693
Beamline: BM02	**Date of experiment**: from: 08/07/2004 to: 12/07/2004	**Date of report**: 13/10/2004
Shifts: 12	**Local contact(s)**: Jean-François BERAR	*Received at ESRF:*

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Report:

The experiments reported here have been performed in the framework of a CNRS-DFG project involving the DLR in Cologne and the CRMHT inOrleans. The two laboratories are specialized respectively in electromagnetic [1] and aerodynamic [2] levitation techniques and they have joined their technologies to develop a new hybrid system combining inductive heating with aerodynamic levitation. The center of this new device is presented on the figure 1. Heating coil and levitation nozzle are housed in a vacuum chamber.

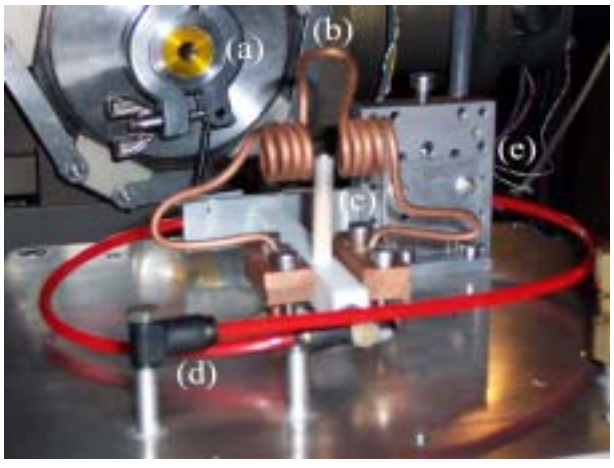

Figure 1. Hybrid system mounted at the BM02 beamline. Incoming x-ray beam (a), RF heating coil (b), Boron Nitride levitator with the spherical sample at the top (c), gas entrance for levitation (d), vertical translation for sample positioning (e)

A spherical sample (diameter=3mm) was levitated using a gas flow going trough a BN nozzle situated in the center of the chamber. Then it was heated to the desired temperature

using the RF coil. In order to avoid oxidation, the chamber was initially pumped down to low pressure and then filled with argon (with 2.5% H_2).

The aim of these first experiments was to study the structure of liquid metals and alloys by combining total x-ray diffraction and EXAFS measurements. Due to hardware problems, we could not install our levitation chamber on the beamline goniometer. Thus, it was not possible to make the diffraction experiments as planned. The setup was finaly mounted on the SAXS experiment table but with this configuration, only EXAFS measurements were performed.

EXAFS measurements were made in the fluorescence mode using a photodiode placed inside the chamber. Figure 2 shows EXAFS spectra obtained with a CoCu alloy at room temperature and at 1050°C. The quality of the measurements is relatively bad, especially at high temperature. At room temperature, this is mostly due to the strong absorption of the signal in the argon atmosphere. At high temperature, we had additional perturbations from the RF coil and from the light emission of the sample. In the future, this difficulty will overcome by a new design of the photodiode system.Calculation are in progress for extracting structural data from these measurements.

An other problem was the difficult adjustment of the sample into the beam. We plan to include a motorized displacement of the nozzle.

In the future, an INEL 120° curved detector will be fixed on the SAXS table. Thus, it will be possible to perform diffraction measurements independently of the goniometer.

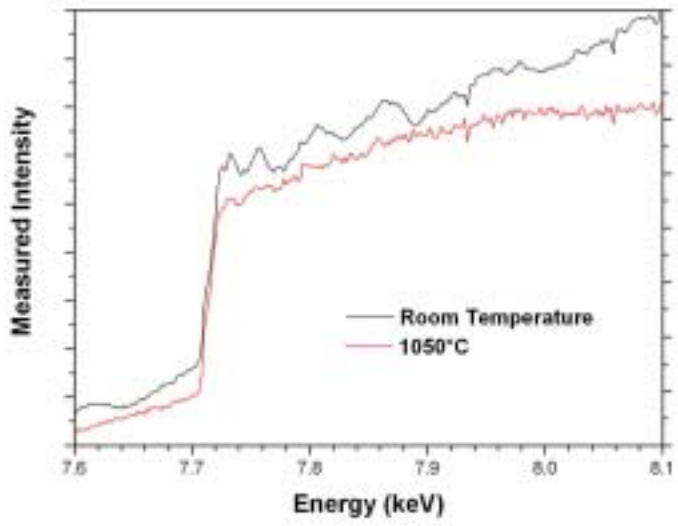

Figure 2. EXAFS measurements performed at the Co-K absorption edge on a CoCu sample. Two temperatures are presented:

- Room temperature (top)
- 1050°C (bottom)

[1] G. Jacobs, I. Egry, K. Maier, D. Platzek, J. Reske, and R. Frahm, Rev. Sci. Instrum. 67, 3683 (1996).
[2] L. Hennet, D. Thiaudière, M. Gailhanou, C. Landron, J. P. Coutures and D. L. Price, Rev. Sci. Instrum. 73, 125, (2002).