

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application:**

<http://193.49.43.2:8080/smis/servlet/UserUtils?start>

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.


Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.



	Experiment title: <i>Velocity measurement in an electromagnetically levitated droplet</i>	Experiment number: MA-590
Beamline:	Date of experiment: from: 30-nov-08 to: 02-déc-08	Date of report: 02-03-09
Shifts:	Local contact(s): Diego PONTONI	<i>Received at ESRF:</i>
Names and affiliations of applicants (* indicates experimentalists): Jacqueline ETAY* – CNRS-SIMAP-EPM (France) Ivan EGRY – DLR-Koln (Germany)		

Report:

EXPERIMENTALISTS /

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Aims of the experiment and scientific background

Electrical conducting materials can be molten, held and stirred without material contact by using induction. These three effects are present in electromagnetic levitation. This processes has two principal applications : processing of materials with very high purity, such as metallic alloys or oxides, and measurement of thermophysical properties of overheated metallic alloys. In both cases, the validation of the numerical models runs up against the absence of experimental data relatives to the velocity measurements inside the levitated droplet. Until now these measurements were not possible because the medium is at a high temperature, preventing any material contact, and it is not transparent at the natural light preventing image velocimetry.

By using a technique of imagery by x-rays we want to measure velocities in an aluminum droplet.

Pre-work

The trials performed on december 1rd, were done following the conclusions of our previous trials (14 and 15th of November 2007). To achieve those, a specific adapted power supply and remote control unit has been developed by a Grenoble-SEM, and an inductor, no generating sample oscillation, has been built. Image processing had been adapted to analyze movies (surface and particles tracking)

First experiments have been performed on 14 and 15th of November 2007, where 5 samples of aluminium were molten in argon gas, levitated. Movies under X-Rays were recorded and analyzed.

It appears that, may be due to oxidation, and poor wetting of WC by aluminum, all particules are captured by free surface.

Therefore, improvements have been done to reduce oxidation problems and improve particles wetting : change aluminum by nickel, increase the power supply available. This change has forced us to change the power supply and to design a new inductor. Because of the ratio electrical conductivity/density relative to the nickel density is 10 time lower than the ratio attached to aluminium, the levitation is much difficult. For the same frequency, the magnetic field intensity must be 3.3 time higher. This increase makes the stabilization of the sample almost impossible with the present type of inductor : i.e. winding copper tube. Therefore, we know before going to ESRF that a stable levitation will be difficult to reach. 30 samples have been proceeded before coming to ESRF.

Trials at ESRF

On 30th of november no X Ray were available due to a computing network problem. All samples have been X ray photographed in two directions in order to get the particules distribution within the samples On 1st of December, 11 nickel samples and 3 of aluminium have been levitated. Among the 11 nickel one, 4 have been molten and movies have recorded. A new problem appears : between each records, the “white” is performed, generating an horizontal translation of the work plane. This motion generates a stability problem of the levitated sample. Further trials with the same sample becomes almost impossible and useless.

The videos records have to be processed. Before any definitive conclusion on the trials performed at the ESRF, we have to complete the analysis of our videos.

**** GENERAL REMARK ON ESRF ORGANISATION**

The computing network problem generates the large amount of work for our correspondent Diego Pontoni and for Marco di Michiel also. They have been working all Sunday along to try to solve the problem. On Monday, the computing team changes a rack and we were allowed to work. A problem arises related to some arrangement in the vacuum chamber. I think that the quality of the provided ray is less than the quality of a year ago. For exemple : a band is darker on the videos. This band is not completely removed when subtracting the white image by image processing.