ESRF	**Experiment title:** Atomic structure of supercooled liquid alloys in levitation	**Experiment number**: HD-592
Beamline: ID15A	**Date of experiment**: from: 18/07/2012 to: 23/07/2012	**Date of report**: 26/02/2016
Shifts: 15	**Local contact(s)**: Jérome Andrieux	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Proposers:
Dr A.R. YAVARI, SIMAP, Grenoble, France *****
Dr L. HENNET, CEMHTI, Orléans France *****
Prof. W. BOTTA, SIMAP, Grenoble *****
Dr. H.-J. FECHT, Karlsruhe Institut for Technology, Eggensteinleopoldshafen, Germany
Dr A. GREER, University of Cambridge, Cambridge, UK

Additional experimentalists
Dr, A. BYTCHKOV, ESRF, France
Dr, K. GEORGARAKIS, SIMAP, Grenoble, France
Dr J. ANTONOWICZ, Warsaw University of Technology, Warsaw, Poland

Report:

Results from this experiment have been published in two papers:

1. K. Georgarakis, L. Hennet, G. A. Evangelakis, J. Antonowicz, G. Bokas, V. Honkimaki, A. Bytchkov, M. W. Chen, A. R.Yavari
   Probing the structure of a liquid metal during vitrification
   Acta Mater. **87** 174-186 (2015)

Abstract.

Using aerodynamic levitation, vitrification of a ternary Zr–Cu–Al alloy was observed in-situ by high energy synchrotron radiation X-ray diffraction in the temperature range from above the liquidus T_{liq} to well below the glass transition temperature *Tg*. The evolution of the atomic struc-ture was studied using pair distribution functions (PDF) and molecular dynamic (MD) simulations. Vitrification was rendered possible due to the enhanced stability of the undercooled Zr–Cu melt after Al addition. Results indicate three regimes in the liquid alloy's structural pathway to vitri-fication. Short (SRO) and medium range order (MRO) develop significantly during cooling the liquid phase to the glassy state. The rate of structural rearrangements is enhanced in the super-cooled liquid between T_{liq}-140 K and *Tg*. The populations of atomic clusters with icosahedral local symmetry become predominant as Tg is approached and facilitate vitrification and suppression of crystal nucleation and growth. The scenario of a possible fragile to strong transition in the super-cooled liquid is discussed.

2. D. V. Louzguine-Luzgin, K. Georgarakis, A. Tsarkov, A. Solonin, V. Honkimaki, L. Hennet, A. R. Yavari
   Structural changes in liquid Fe and Fe–B alloy on cooling
   J. Mol. Liq. **209**, 233-238 (2015)

Abstract.

The existence of liquid liquid phase transitions has been suggested for liquid Fe and some of its alloys. In order to shed light on this phenomenon in-situ cooling of the $Fe_{80}B_{20}$ and Fe melts was performed under a synchrotron beam radiation. It allowed for the continuous acquisition of X-ray diffraction spectra in the supercooled liquid region below the liquidus temperature. The procedure allowed monitoring of the structural changes in the supercooled liquid state using real-space atomic pair PDF(r) and radial RDF(r) distribution functions. The results are discussed in comparison with those of molecular dynamics simulation for liquid Fe.