ESRF	**Experiment title:** Glass forming ability of BMG's based on common metals	**Experiment number:** 16-01 754
Beamline: BM16	**Date of experiment:** from: 08/02/2010 to: 08/02/2010	**Date of report:** 15/02/2010
Shifts: 1	**Local contact(s):** Ana Labrador	*Received at ESRF:*

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Report:
Two families of bulk metallic glasses has been studied, one based on Zr with promising biomedical applications and the other one based on Fe, also know as amorphous steels.
The amorphous steels has been produced in ribbon shape with ultra-high quenching conditions and in rod shape with slow cooling rates. Two different moulds have been used to produce the rods, one with a 3 mm diameter and the other with a 5 mm diameter. Several alloys has been tested varying the relative amount of Fe and Y while keeping constant the atomic percentage of Cr, Mo, C and B. The rods produced without Y are crystalline whereas the addition of Y yields an amorphous rod, thus showing the importance that minor additions of Y play in improving the glass forming ability (GFA) of these alloys (see Figure 1). At the same time, all the produced ribbons of this family produced a diffraction spectra typical of amorphous samples.

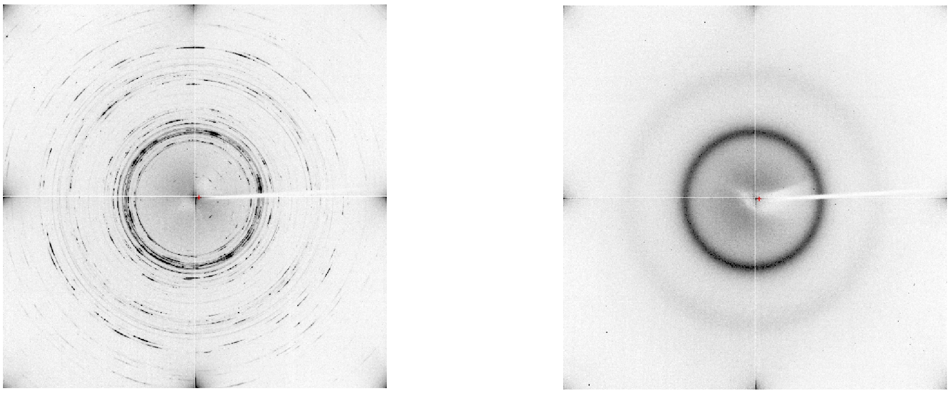

Figure 1.(Left) Diffraction of the rod without Y. (Right) Amorphous character of the Y-containing rods

The Zr-based compositions have been produced only in ribbon shape and we tested three different compositions in which the relative amount of Zr and Cu have been varied keeping constant the amount of Fe and Al. In this case, there is Cu in all the samples but as its amount increases, the GFA increases. The two compositions with highest amount of Cu have been shown as amorphous while the lowest Cu containing one has yield an amorphous diffractogram but with crystalline spots (see Figure 2). It is worth to emphasize here this last result because this last sample would be classified as amorphous if checked using a conventional diffractometer.

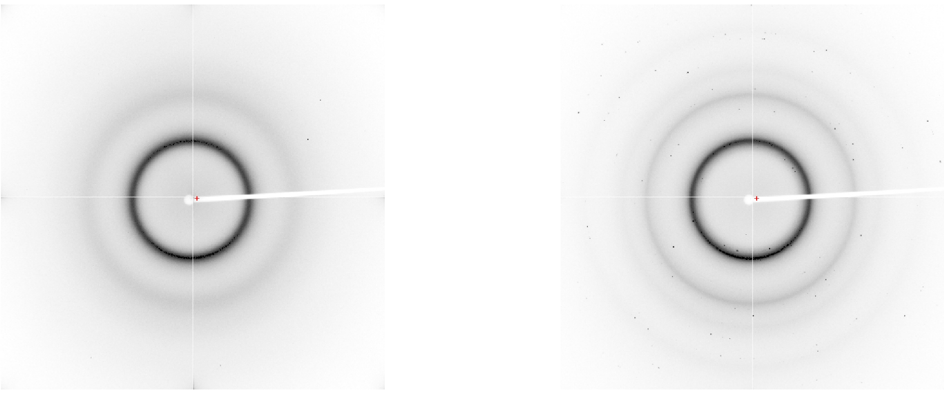

Figure 2.(Left) Amorphous ribbon with high Cu content. (Right) An amorphous ribbon with some crystalline signal

Therefore, this experiment has yield two results: **a)** to check the amorphicity of the produced samples and thus select the compositions that will be used for forthcoming corrosion experiments and **b)** to stress the importance of synchrotron radiation in order to determine the amorphicity of a sample; without the high resolution obtained in a synchrotron it is not possible to ascertain if in some sample there is no crystalline traces.

Moreover, the homogeneity of the produced rods was checked. To do that, a 1 mm diameter rod of a $Pd_{77}Si_{16.5}Cu_{6.5}$ bulk metallic glass was produced. Three sections of the rod were cutted using a diamond saw. These sections corresponded to the extreme of the rod in contact with the melted master alloy (called drop), the central part of the rod and the other extreme of it. The diffraction patterns reveal that not all the rod is amorphous, being the drop section crystalline (see Figure 3). Thus, this result is an indication of the presence of a longitudinal temperature gradient that can result in a non-homogeneous rod.

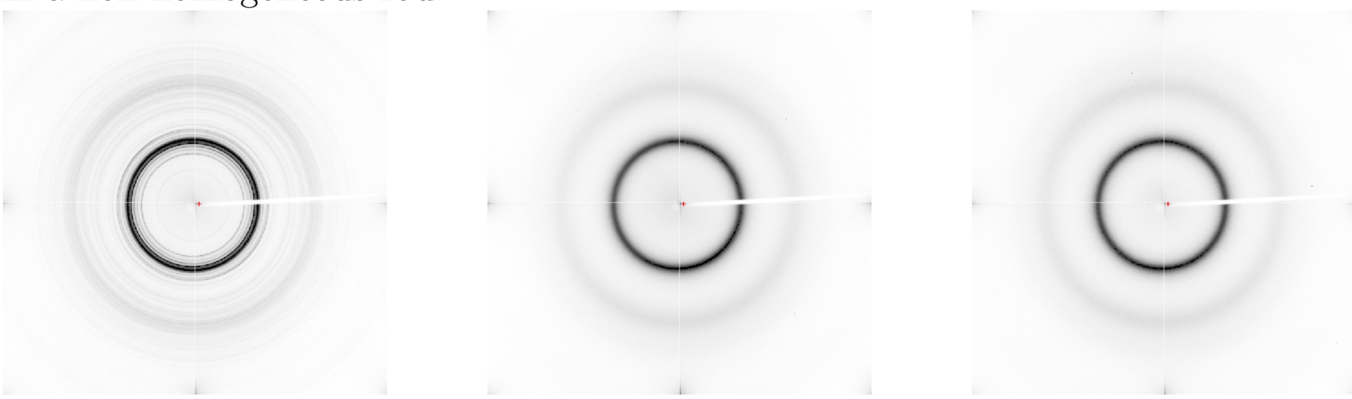

Figure 3.(Left) Drop section - crystalline.(Middle) Center of the rod - amorphous (Right) Extreme of the rod - amorphous