# Generation of a TTT - diagram using an Iron-based bulk amorphous alloy

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Bulk Metallic Glasses (BMG) properties offer great opportunities for industrial applications to replace commercial iron or aluminum alloys in near-net-shape processes. Rapidly solidified {(Fe0.6Co0.4)0.75B0.2Si0.05}96Nb4 BMG droplets were generated by Impulse Atomization (IA) under nitrogen/helium atmosphere.

Determination of the amorphous fraction and kinetic crystallization properties of the obtained droplets was achieved by Differential Scanning Calorimetry (DSC) and Neutrons Diffraction (ND) at room temperature. The objective of the present work is to build an isothermal transformation diagram or "time-temperature-transformation" TTT-diagram of the atomized BMG.

The plan was to heat and hold all the samples summarized in Table I at two temperatures of 600°C and 300°C respectively. However the amount of material left after previous Neutrons Diffraction was not sufficient. It was therefore decided to carry out one test only.

Table I: Summary of FeCo-bulk amorphous samples chosen for heat treatment

| Priority sequence | Sample information | | | Microstructure expected |
|---|---|---|---|---|
| | Composition | Atmosphere | Size [µm] | |
| H2-FeCo-106 | $FeCo_{35.2}B_{4.3}Si_{2.8}Nb_{7.7}$ | Helium | 106 - 125 | amorphous |
| **H3-FeCo-125** | **$FeCo_{35.2}B_{4.3}Si_{2.8}Nb_{7.7}$** | **Helium** | **125 - 150** | **amorphous** |
| Priority sequence | Sample information | | | Microstructure expected |
| | Composition | Atmosphere | Size [µm] | |
| H2-FeCo-106 | $FeCo_{35.2}B_{4.3}Si_{2.8}Nb_{7.7}$ | Nitrogen | 106 - 125 | amorphous |
| **H3-FeCo-125** | **$FeCo_{35.2}B_{4.3}Si_{2.8}Nb_{7.7}$** | **Nitrogen** | **125 - 150** | **amorphous** |

In-situ Neutron diffraction was carried out during the heat treatment of droplets with size of 125 µm atomized in Nitrogen and in Helium. The temperature was ramped at the rate of 300°Cmin$^{-1}$ to 600°C. Data were collected every 6-min, so that several scans were combined into one to get a reasonable statistics.

Example of the collected datasets is given in Fig.1. The diffraction patterns recorded at the target temperature (600°C) correspond respectively to the first 6 minutes, after 2.5 hours and at room temperature. As can be seen, no transformation has taken place.

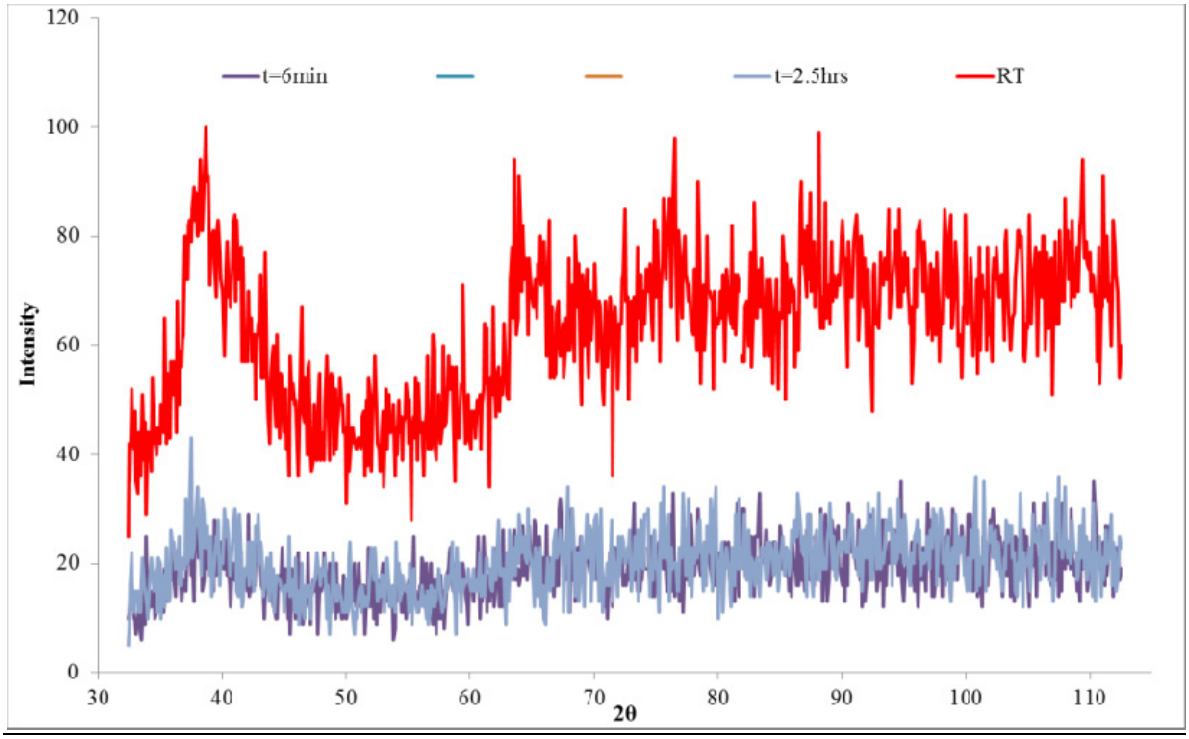


***Figure 2:*** *Diffraction patterns obtained from the neutron beam during heat treatment experiments of* $FeCo_{35.2}B_{4.3}Si_{2.8}Nb_{7.7}$ *droplets of size 125 µm atomized under nitrogen.*