ESRF	**Experiment title:** Kinetics of crystallization of nanocrystalline alloys	**Experiment number**: MA-1492
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Report:

Results obtained during this experiment were in the mean time accepted for publication in Miglierini M., Pavlovič M., Procházka V., Hatala T., Schumacher G. and Rüffer R.: *Evolution of structure and local magnetic fields during crystallization of HITPERM glassy alloys studied by* in situ *diffraction and nuclear forward scattering of synchrotron radiation*, Physical Chemistry Chemical Physics, 2015 (DOI: 10.1039/C5CP00245A).

Abstract:

Nanocrystalline alloys are suitable materials for variety of applications owing to their excellent magnetic properties that originate from the presence of nanocrystalline grains embedded in an amorphous matrix. Nanograins are formed during heat treatment of an original metallic-glass precursor and they strongly affect the resulting properties including magnetic parameters. That is why the evolution of structural transformation(s) during the heat treatment that converts the parent metallic glass into a nanocrystalline alloy is of paramount importance. Routinely, only the final stage of this transformation is studied by conventional analytical tools. They provide integral information from the whole bulk of the complex structure without any differentiation of the impact of diverse amorphous and nanocrystalline structural regions. Very frequently, these methods are also long lasting and cannot provide an opportunity for investigation of transition processes during the transformation. This paper presents potential of *in situ* techniques based on synchrotron radiation applied during the investigation of structural transformations in metallic glasses and nanocrystalline alloys. The effects of chemical modification of their chemical composition are demonstrated on $(Fe_{1-x}Co_x)_{76}Mo_8Cu_1B_{15}$ metallic glass with various amounts of Co ($x = 0$, 0.25, 0.5). Diffraction of synchrotron radiation and nuclear forward scattering of synchrotron radiation are employed to follow the evolution of structural parameters and hyperfine interactions, respectively. The data are collected on-fly in real time during *in situ* temperature annealing.

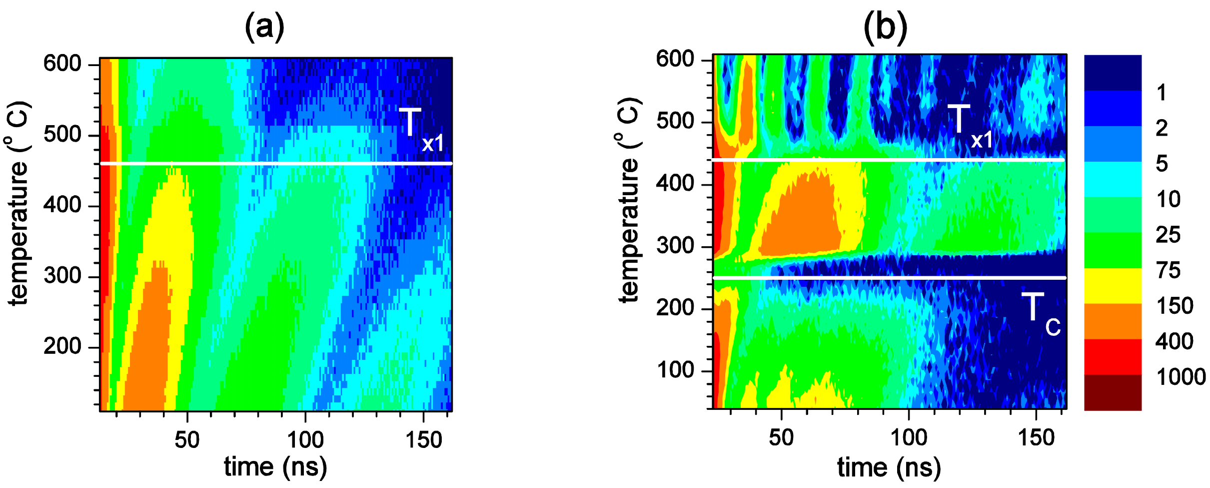

Fig. 1. Contour plot of 3-D nuclear forward scattering data of $(Fe_{1-x}Co_x)_{76}Mo_8Cu_1B_{15}$ for $x = 0$ (a) and $x = 0.25$ (b). Crystallization T_{x1} and Curie T_C temperatures are indicated by the horizontal white lines..

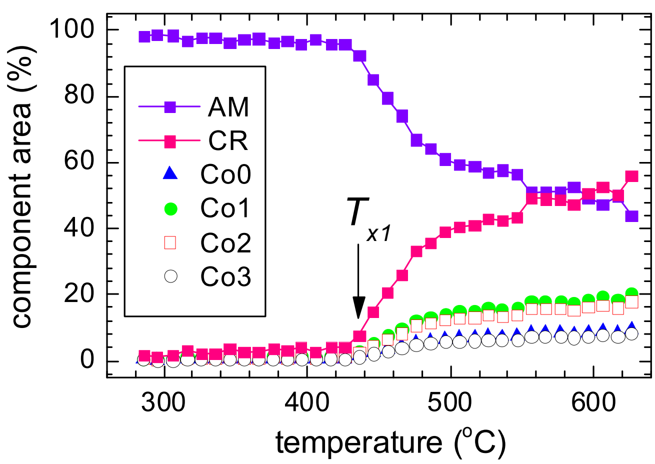

Fig. 2. Fraction of the residual amorphous matrix (AM) and bcc-(Fe,Co) crystalline phase (CR) plotted against the annealing temperature as obtained from the fitting of *in situ* NFS data of the $(Fe_{1-x}Co_x)_{76}Mo_8Cu_1B_{15}$ ($x = 0.25$) alloy. Fractions of crystalline sites with different amounts of Co nearest neighbours (Co0 – Co3) are also given. Solid lines are only guide to the eye. The arrow indicates the onset of crystallization T_{x1}.

Another publication is under the preparation.