ESRF	**Experiment title:** **Clustering and nanocrystallization during annealing of magnetoelastic amorphous alloys**	**Experiment number**: 08-01-246
Beamline: BM 8	**Date of experiment**: from: dal 22/11/2000 to: al 24/11/2000	**Date of report**: February 28, 2001
Shifts: 9	**Local contact(s)**: C. Meneghini	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

G. Ausanio* *Dip. Scienze Fisiche, Università Federico II di Napoli*
C. Aruta *INFM-Università di Roma "Tor Vergata"*
S. De Panfilis *Dip. Matematica e Fisica, Università di Camerino*
L. Lanotte *Dip. Scienze Fisiche, Università Federico II di Napoli*
F. Miletto Granozio* *INFM, Unità di Napoli*
M. Minicucci* *Dip. Matematica e Fisica, Università di Camerino*
F. Ricci* *Dip. Scienze Fisiche, Università Federico II di Napoli*
U. Scotti di Uccio *Dip. Scienze Fisiche, Università Federico II di Napoli*

REPORT

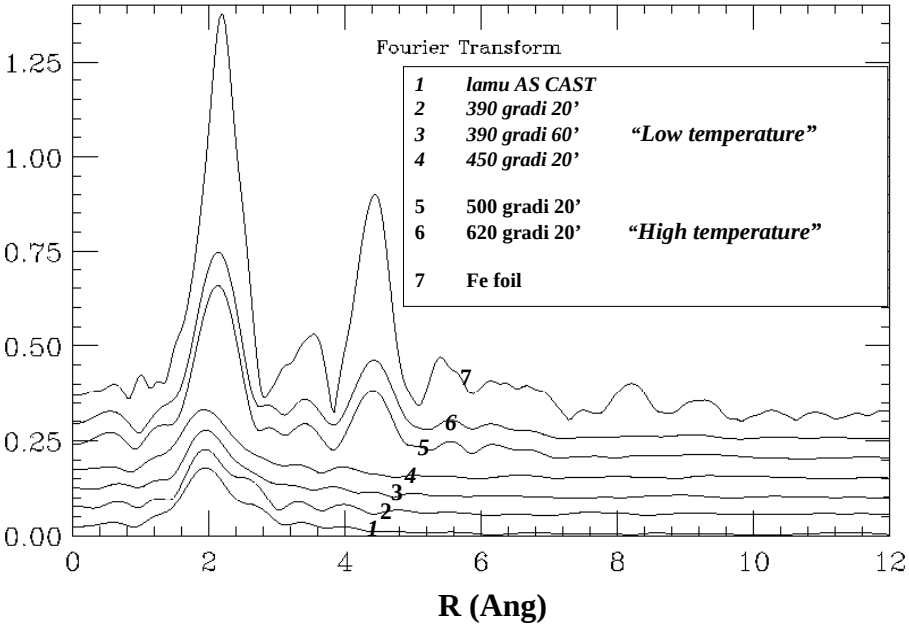
In the last few years an increasing interest in the development of magnetomechanical sensors and devices operating by resonant magnetoelastic waves has arisen, since the potential of such devices to compete with piezoelectric, resistive and optic sensors has been demonstrated. In this framework, a new ultra soft ferromagnetic amorphous alloy ("LaMu", $Fe_{62.5}Co_6Ni_{7.5}Zr_6CuNb_2B_{15}$), possessing a largely superior amplitude of the resonant magnetoacustic waves at zero magnetic fields with respect to traditional magnetoelastic alloys, was recently ideated and produced by some of the applicants.

The aim of the feasibility study was essentially to evaluate the possibility of "in situ" monitoring the formation of a short range order and/or the nanocrystallization of αFe particulates in LaMu, during different annealing procedures. The relevant temperature range for structural relaxation and nanocrystallization had been previously identified on the base of DTA analyses correlated with X-ray diffraction and the study of the magnetic properties. The X- Ray absorption experiment has been performed in transmission geometry at the Fe, Co and Ni K-edges on chemically thinned, 10mm thick, LaMu ribbons. The EXAFS and XANES spectra have been collected during the in-situ isothermal annealing of the samples in high vacuum, by using a furnace based on a graphite heating element.

A set of Fourier transforms from data collected during isothermal annealing at different temperatures of six "LaMu" samples are plotted in the enclosed pictures, and compared with data from a Fe foil. From the comparison between the "low temperature" (1,2,3 and 4) and "high temperature" (5 and 6) curves, the onset of short range order formation in between 450°C and 490°C clearly appears. From the "high temperature" patterns , the presence of the bcc α-Fe is recognized. Another interesting phenomenon which is suggested by our spectra, is the possible formation of a metastable short range order that takes place at 390°C but is destroyed at longer annealing time or higher annealing temperatures.

A further interesting result suggested by our preliminary analysis regards the Co and Ni spectra. The data demonstrate a short range order that is inconsistent with the typical bulk structure of such elements, and possibly consistent with a bcc phase. This would suggest that Co and Ni atoms are located as impurities in Fe sites of α-Fe crystallites.

Data analysis based on the GNXAS code are in progress. An application for a continuation of the experiment is currently being submitted.



Fourier transforms of some collected spectra.