ESRF	**Experiment title:** Tensile stress induced magnetoelastic effects in FeZrB metallic glasses studied by magnetic dichroism	**Experiment number:** HE-252
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Report:

FeZr glasses have attracted large interest in the past years [1, 2] as a very peculiar magnetic system displaying magnetic re-entrant spin-glass bahaviour and INVAR character. The Curie temperature shows a large dependence on hydrostatic pressure, this dependence is larger in low Zr containing glasses, showing the same trend as the spin-glass behaviour. A recent study on FeZrB amorphous ribbons shows the existence of a large influence of the simple tensile stress (up to 1.2GPa) on the Curie temperature [3], having Tc near room temperature. The results on different compositions also indicate that the addition of Boron greatly enhances the intinerant weak ferromagnetism that describes the behavior of FeZr alloys [3].

In order to test the previous assumptions, we have performed Fe K-edge Magnetic Circular X-ray Dichroism (MCXD) on $Fe_{88}Zr_8B_4$ (B4) and $Fe_{87}Zr_6B_6Cu_1$ (B6) amorphous ribbons. MCXD is a probe of the local magnetic properties of the absorbing atom. Eventhough, the interpretation of K-edge MCXD spectra is still far from being resolved, variations of MCXD amplitudes are correlated to variations in the local magnetization, and the spectra can therefore be studied as a function of external parameter as an external magnetic field or applied pressure.

Fe88Zr8B4 (B4) and Fe87Zr6B6Cu1 (B6) amorphous samples were obtained, under controller atmosphere, by melt-spinning in the form of long ribbons. Typical dimensions of their cross section are 2 mm wide and 20 μm thick. Their Curie temperature are near room temperature, Tc = 283 K for (B4) and Tc = 300 K for (B6).

We have performed Fe K-edge Magnetic Circular X-ray Dichroism (MCXD) on B4 and B6 amorphous ribbons under tensile stress in the beam line ID24. For this purpose, we have prepared a sample holder that allows to apply tensile stress up to 2GPa, by means of a spring system. We could get strains in the range of 1% with perfect elastic recovery. The deformation were measured with a strain gage. The absorption spectra at room temperature were measured in transmission geometry with a magnetic field applied traverse to the ribbon. The intensity of the magnetic field varies between 0 and 1.1Tesla. Fig.1 shows the effect of the tensile stress on the dichroism signal for the two studied samples. In both samples it is well observed an increament of the maximum amplitude of the MCXD signal.

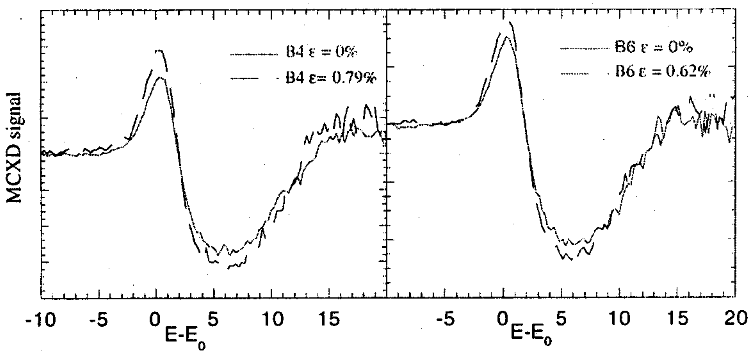

Fig. 1 - MCXD signal at room temperature for Fe88Zr8B4 (B4) and Fe87Zr6B6Cu1 (B6), with and without stress, under magnetic field applied traverse to the ribbon. The intensity of the magnetic field is 0.95T for B4 and 1.1T for B6.

On the other hand, we have measured in a SQUID magnetometer the magnetizatization of the samples at room temperature with the magnetic field applied traverse to the ribbon, in the same condition used to obtain the dichroism signal. In fig.2a, we present the magnetization as a function of the maximum amplitude of the MCXD signal, both measured at the same magnetic field, (μ_0H = 0.25, 0.58, 0.83 and 0.95 Tesla for B4 and μ_0H = 0.67, 0.95, 1.1 Tesla for B6). The linear behaviour found stablishes unambiguously that the maximum amplitude of the dichroism signal is correlated to the magnetic moment of the absorbing atom, in this case the Fe one.

Fig. 2b shows the evolution the maximum amplitude of the MCXD signal as a function of linear deformation for Fe88Zr8B4 (B4) and Fe87Zr6B6Cu1 (B6) for the highest magnetic field. In both samples it is clearly observed a linear increases of the MCXD signal with the deformation, ε.

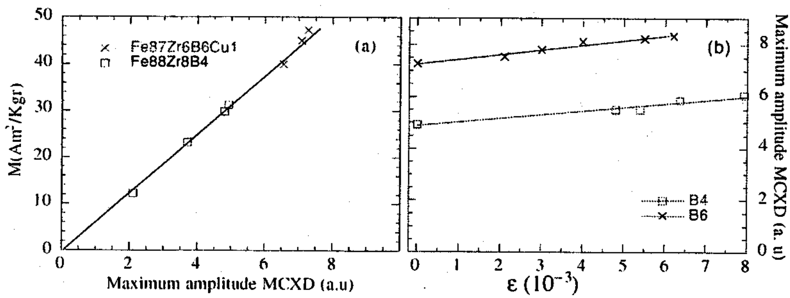

Fig. 2. (a) - Magnetization as a function of the maximum value of MCXD signal for Fe88Zr8B4 (B4) and Fe87Zr6B6Cu1 (B6) under magnetic field applied traverse to the ribbon (μ_0H = 0.25, 0.58, 0.83 and 0.95 Tesla for B4 and μ_0H = 0.67, 0.95, 1.1 Tesla for B6). (b) - maximum value of MCXD signal as a function of deformation, ε, for the highest applied field (μ_0H =0.95 Tesla for B4 and μ_0H =1.1 Tesla for B6)

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