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EXAFS STUDY OF $(Fe_xCo_{1-x})_{75}Si_{15}B_{10}$ METALLIC GLASSES.

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Metallic glasses present outstanding properties of technological interest specially as magnetic materials. Magnetic properties of $(Fe_xCo_{1-x})_{75}Si_{15}B_{10}$ amorphous alloys such as spontaneous magnetization, magnetostriction and Curie Temperature depend strongly on composition (1). In order to understand their unique characteristics it would be necessary to have some structural information.

Amorphous ribbons of composition $(Fe_xCo_{1-x})_{75}Si_{15}B_{10}$ were prepared by the single roller quenching technique (2) and result in long ribbon with typical cross section of 0.5mm wide and 20μm thick.

X-ray absorption spectra were recorded on Fe and Co K edge at Frascati Synchrotron Radiation PULS Facility at room temperature using a Si (111) channel-cut monochromator. The detection of the X-ray beam was achieved by two Ar-filled ionization chambers.

The data analysis was done using the EXAFS program package developed at PULS following the standard procedure of deglitching, background removal, extraction of EXAFS signal $\chi(k)$, Fourier Transform with a weight k^1 and a Gaussian window function, and finally Inverse Fourier Transform to isolate EXAFS contribution from a selected region in real space.

In order to extract structural information, the so-filtered data were fitted to the widely used formula, where the symbols have the usual meanings (3):

$$k\chi(k) = \sum_j N_j \, |f_j(k,\pi)| \, e^{\sigma_j^2 k^2} \, e^{-2r_j/\lambda} \, \mathrm{sen}[2kr_j + \phi_{ij}(k)]/r_j^2$$

A quantitative analysis in such samples is not a simple matter and it would be necessary to make some assumptions. Because of the very similar atomic number value of Fe and Co it is supposed that there is not difference between them as backscattered. On the other hand the contribution of the Fe-B or Co-B pair is very small and finally metalloid-metalloid pair is completely negligible.

Lee et. al (4) phase shifts and backscattering amplitudes were used for simulating theoretical spectra Fe-Fe and Fe-Si taking the following interatomic distances: $R_{Fe\text{-}Fe}$=2.58A $R_{Fe\text{-}Si}$=2.4A. The generated spectra were used to simulate the glass spectra where the simulation was done using two shells, one Fe shell + one Si shell. The derived parameters for the $(Fe_xCo_{1-x})_{75}Si_{15}B_{10}$ metallic glasses are given in the following table, being 1 refered to the Fe (or Co as long as we can not distinguish between them)and 2 to the Si as backscattered, respectively.

Sample	K edge	N1	N2	N1+N2	R1	R2	$\Delta\sigma 1^2$	$\Delta\sigma 2^2$
x = 1	Fe	5.8	3.1	8.9	2.45	2.53	.017	.011
x = .5	Fe	5.7	3.6	9.3	2.42	2.5	.009	.000
	Co	8.33	3.54	11.87	2.33	2.35	.015	.003
x = .2	Fe						.	
	Co	8	3.42	11.42	2.33	2.33	.018	.006
x = .1	Fe	3.64	1.73	5.37	2.45	2.52	.009	.000
	Co	6.4	4	10.4	2.33	2.36	.010	.003
x= 0	Co	7.15	3.55	10.7	2.32	2.36	.012	.003

From the data it can be seen that the environment of Fe and Co is rather different according to the coordination number (N) and the interatomic distance (R).

The latter does not change with composition but we have to bear in mind that metal and metalloid content keeps constant in all samples.

Fe total coordination number decreases strongly when the Co content is high. This could be due to the fact that we are not taking into account the B contribution. On the other hand, Co coordination number does not change appreciable with composition. Coordination number behaviour could suggest a not homogeneous distribution of metalloid with preferential coordination of Fe-B and Co-Si. Magnetic properties dependence with composition could be related with this metalloid distribution.

Finally, while for metal-metal pair $\Delta\sigma 1^2$ presents a rather high value which indicates an important structural disorder for metal-metaloid pair $\Delta\sigma 2^2$ value is typical of vibrational disorder.

In this work we have seen that EXAFS technique is a good tool for structural studies in complex metallic glasses.

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