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Abstract : The short-range orders in the surface layer and in the bulk of $Fe_{80}B_{20}$ ferromagnetic amorphous ribbons are evaluated by conversion electron emission (CEMS) and γ-transmission Mössbauer spectroscopy. Results can be interpreted supposing that the quenching rate of the contact-surface is higher than that of the bulk.

The knowledge of the physical parameters related to the structure of amorphous materials is of fundamental importance to improve their magnetic, electrical and mechanical properties. Three kinds of short-range order exist in metallic amorphous alloys, *i.e.* chemical (CSRO), topological (TSRO) and bond order (BSRO). The magnetic hyperfine fields distribution obtained using the Mössbauer spectroscopy can give useful informations on the different kinds of local order owing to its sensitivity to the local environment.

In this paper we report the evaluation of the three kinds of local order (CSRO, TSRO, BSRO) in the surface layer 1000 Å thick as well in the bulk of $Fe_{80}B_{20}$ ferromagnetic amorphous ribbons obtained by melt-spinning technique with roller peripheral speed of 30 m/s; check by X-ray diffraction ensures no long-range order in the samples.

The $Fe_{80}B_{20}$ amorphous alloy exhibits an hyperfine magnetic fields distribution $p(H)$ which is sensitive to the local environments and therefore to their order degree. The $p(H)$ distribution in the surface and in the bulk was measured by conversion electron emission (CEMS) and γ-transmission Mössbauer spectroscopy respectively. The best-fit of this distribution function was done by a superposition of gaussians centered on the hyperfine fields corresponding to local structures having the same CSRO: stable structures as-like Fe_2B and metastable ones as-like Fe_3B and off-stoichiometry clusters. The full width at half maximum (FWHM) of each gaussian represents the fluctuation degree in the distance of the first neighbours atoms and therefore it turns out to be related to the TSRO corresponding to each CSRO configuration [1].

The characteristic strong asimmetry of the amorphous $Fe_{75}B_{25}$ Mössbauer spectra has been attributed to an anisotropic magnetic hyperfine field H_{an} = 1.4 T [2] and explained as the result of the anisotropic fields in Fe_2B and Fe_3B structures. A combined interaction of the nuclear moments with uniaxial electric field gradient and with two inequivalent directions of spin orientations take place in these structures inside a magnetic domain. Therefore the difference between these two fields values is a measure of the amount of anisotropic hyperfine field H_{an} [3]. We take into account this fact by considering two gaussian for each CSRO whose distance is varied to minimize the weighted mean square deviation χ^2 [1]. The distance of each gaussian pair gives the H_{an} values shown in the enclosed table.

The models of supercooled Lennard-Jones liquids and glasses based on dense random packing of spherical molecules favour the icosahedral structure [4] which gives a vanishing H_{an} value in the undistorted configuration. Therefore H_{an} can be considered a measure of the distortion degree of the icosahedral structure and then of the BSRO in amorphous alloys.

By comparison of the different short-range orders in the contact-surface to the roller and in the bulk and starting from the surface we observe: (i) a reduction of the TSRO, (ii) an increase of the relative amount of as-like Fe_2B structure and of its distortions, (iii) a reduction of the relative amount of as-like Fe_3B structure and of its distortions.

These behaviours can be attributed to the higher quenching rate on the contact surface. This conclusion is deduced by comparing these results with those in previous paper [1,5] were we have examinated short-range orders in the bulk of $Fe_{80}B_{20}$ amorphous samples obtained with different quenching rates.

	surface-contact			bulk		
	Fe_2B	Fe_3B	others	Fe_2B	Fe_3	others
Area (%)	21.(2)	63.(8)	15.(0)	26.(8)	58.(1)	15.(1)
FWHM (T)	1.4(4)	2.1(7)	—	2.6(8)	2.5(0)	—
H_{an} (T)	0.8(5)	1.3(6)	—	1.2(1)	0.8(7)	—

FWHM and H_{an} are related to TSRO and BSRO respectively

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