THE AMORPHOUS WIRES REMAGNETIZATION PECULIARITIES.

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We present the results of experimental and theoretical investigations of magnetostatic properties of the amorphous wires $Fe_{77.5}Si_{7.5}B_{15}$ and $(Co_{0.94}Fe_{0.06})_{72.5}Si_{12.5}B_{15}$ with diameter 130μ and different lengths. The strong dependence of magnetization reversal processes in amorphous wires with positive magnetostriction $\lambda>0$ on their length has been reported [1]. To clarify the role of magnetostriction on magnetostatic properties we investigated the remagnetization in wires exhibiting positive (Fe-based) as well as negative (Co-based) magnetostriction. The measurements were performed by Vibrating Sample Anisometer in fields up to 8 кOe. Magnetic field was oriented in parallel ($\mathbf{H}_{||}$) or perpendicularly ($\mathbf{H}_{\perp}$) to the wire axis. Two magnetization components $\mathbf{M}_{||}$ and $\mathbf{M}_{\perp}$ were determined at both field orientations (Fig.1-3).

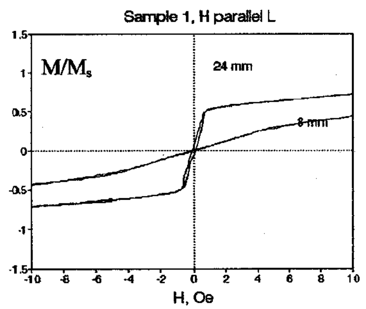

Fig. 1. The longitudinal remagnetization $M_{//}(H_{\perp})$ for short and long Fe-based samples

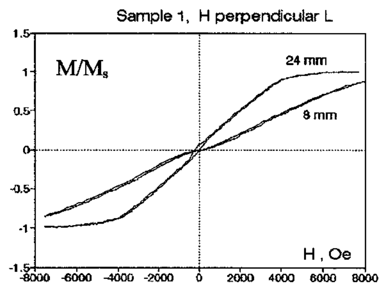

Fig.2. The cross remagnetization $M_{//}(H_{\perp})$ for short and long Fe-based samples

One can see the strong dependence of hysteresis loop shape on the sample length. It should be noted that at longitudinal field the magnetization reversal in Co-based wire is analogous to shown in Fig.1. In the case of cross remagnetization the saturation field $\mathbf{H}_{\perp s}$ significantly decreases for short Fe-based wires (Fig.2) but does not change with length for Co-based samples. The magnetisation component $M_{||}$ along the wire axis at cross remagnetization is shown in Fig.3. It follows from these data that the coherent character of remagnetization becomes stronger with length decreasing. The numerical values of magnetostatic parameters are presented in Table1.

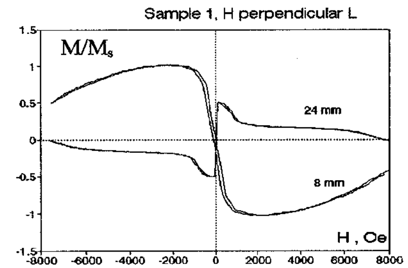

Fig.3. The cross remagnetization $M_{\perp}(H_{\perp})$ for short and long Fe-based

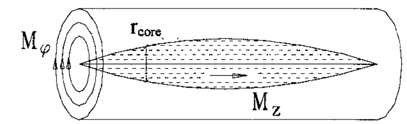

Fig.4. Twisting of the magnetization in the core region of a short piece for Co-based wire.

Table 1.

	Length mm	Coercivity H_c, Oe	Cross saturation $H_{\perp s}$, Oe	$M_{\perp max}(H_{\perp})$ %M_s	M_r/M_s	r_{core}/R_{wire}
$Fe_{77.5}Si_{7.5}B_{15}$	24	0.08	4400	30	1.02*10^{-4}	0.7
$Fe_{77.5}Si_{7.5}B_{15}$	8	0.06	8800	90	0.48*10^{-4}	0.55
$(Co_{0.94}Fe_{0.06})_{72.5}Si_{12.5}B_{15}$	24	0.09	3750	45	0.16*10^{-2}	0.95
$(Co_{0.94}Fe_{0.06})_{72.5}Si_{12.5}B_{15}$	8	0.37	3750	95	4.00*10^{-2}	0.85

It can be concluded that the main magnetostatic parameters H_c and H_s quite different depend on length in positive and negative magnetostrictive wires.

To explain this behaviour we calculated the magnetization distribution in a core and in an outer shell of amorphous wire with different lengths. It is shown that the radius of a wire core may be smoothly reduced to zero due to demagnetizing field of the magnetic charge near the wire ends with length decreasing. The twisting of the magnetization distribution in the inner core of wire with $\lambda<0$ is shown in fig 4. The obtained dependencies of magnetostatic parameters on wires length are in a qualitative agreement with the experimental data.

Reference.

1. M. Vasquez and D.-X.Chen, IEEE Trans on Magn, vol.31, no.2 (1995), 1229-1238

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