Determination of effective anisotropy in nanocrystalline soft ribbons regarding magnetostrictive contributions

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9.7 cm

Magnetically soft nanocrystallized ribbons exhibit phenomena of breakage and multiplication of domain walls at a few $10^4 Hz$. That method was applied to 4 samples to determine the surface energies of walls, typically 10^{-5} $J.m^{-2}$. The effective densities of anisotropy energy on the wall scale were found in the range 3 to 40 $J.m^{-3}$, depending on the degree of recrystallization. The data were interpreted by taking account of the possible sources of anisotropy : random crystalline (nanograins), uniaxial (field annealing), magnetoelastic (stress). A simple model adapted from the classical random anisotropy model (Herzer) describes the way the above terms combine on the wall scale. The random contribution from nanograins is short-range and averaged by the walls. On the contrary, the uniaxial induced anisotropy is long-range. By comparing the experimental data with the model, it is shown that the magnetoelastic contribution features a correlation length bigger than the wall thickness. Depending on the degree of recrystallization, the estimated stress lies between 0.3 and 1.3 MPa. It arises from both the quenching stresses relaxed by annealing and the magnetoelastic stresses due to the coexistence of the amorphous and crystal phases.

13.4 cm

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