Magnetization Processes in Stressed Annealed Amorphous Ribbons

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Abstract. Amorphous magnetic ribbons Vitrovac 6025 ($Co_{66}Fe_4Mo_2Si_{16}B_{12}$) with low magnetostriction [1] were used in this study. Heating the sample in the furnace under a simultaneous application of tensile mechanical stress made it possible to induce in the sample anisotropy with the in-plane magnetic easy axis in normal to the ribbon axis. In the combination with the shape anisotropy, this led to the easy magnetization axis in the transverse plane of the ribbon. If the mechanical stress and the temperature are sufficiently homogeneous, the well-defined anisotropy in the sample with typical magnetic stripe domain structure (stripe structure) perpendicular to the ribbon axial (longitudinal) axis can be obtained [2]. Such domain structure can be easily manipulated by the electric current (a circular magnetic field) flowing through the sample. As discussed in [3], a different domain structure with a single domain wall parallel to the ribbon surface can exist (circular structure).

Using our experimental set-up, axial and circular hysteresis loops can be measured while the current flows throw the sample (applied circular magnetic field). The studied sample was inserted into a pick-up coil which was fixed in the long magnetizing coil (solenoid) creating an axial external magnetic field. The four silver contacts (two outer and two inner) attached to the sample made it possible to control the electric current from power supply flowing through entire sample (outer contacts), or just through its inside part (inner contacts) creating circular magnetic field in the sample.

The aim of this research was to study the ribbon domain structure by measuring hysteresis loops influenced by direct current flowing through the ribbon. The influence of magnetic history of the ribbon as well as the influence of both applied magnetic fields (axial and circular) on the domain structure were studied. From the measurements of axial hysteresis loops for three different currents flowing through the sample the expected decrease in axial magnetization as well as its increase in a small axial magnetic field resulted. The presence of a small helical anisotropy on the circular hysteresis loop was observed. Above a current value of 3 mA, the total circular magnetic flux was reduced and above 40 mA, the sample was completely circularly magnetized (circular structure). This behaviour can be explained by the transformation between two possible domain structures (stripe and circular) in the studied sample [3].

The same experiments are intended to be performed on a ribbon, which is annealed in transverse magnetic field, i. e. with an induced transverse easy axis.

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