Properties of Fe-based Microwires

Serghei BARANOV
Institute of Applied Physics of Moldova
baranov@phys.asm.md

***Abstract* - The Fe-based composition of cast amorphous glass-coated microwires with positive magnetostriction constant is investigated. The residual stresses distributions in this type of microwires determine domain structures and switching field behavior. These allows us to formulate a phenomenological expression for the temperature dependence of the switching field, which is in very good agreement with the experimental result**
***Index Terms* - cast amorphous glass-coated microwires, domain structures, switching field.**

1. INTRADUCTION

Glass-coated amorphous microwires may be fabricated by quenching and drawing method. They are composite materials formed by an amorphous metallic core (1–20 mm in diameter) covered by Pyrex-like insulating coating (2–20 mm thick) (see Fig.1). Although prepared since three decades ago, interest has risen recently due to new preparation and measuring techniques as well as envisaged technological applications derived from their outstanding magnetic properties and small dimensions.

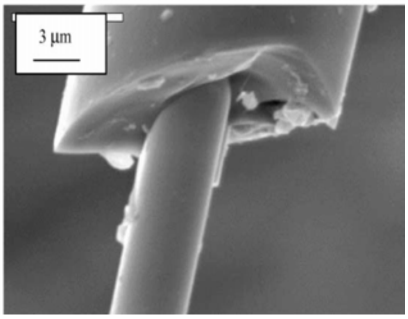

Fig.1. Scanning Electron Microscopy, SEM. Glass-coated amorphous microwire

2. MAGNETIC PROPERTIES

The residual stresses are the result of differences in the coefficients of thermal expansion of the metal and of the glass. In the fabrication of cast amorphous glass-coated microwires the residual stresses increase from the axis, attaining their maximum values on its surface.The cast Fe–based microwires with a positive magnetostriction constant λ show a rectangular hysteresis loop with a single and large Barkhausen jump between two stable magnetization states (see Fig.2).

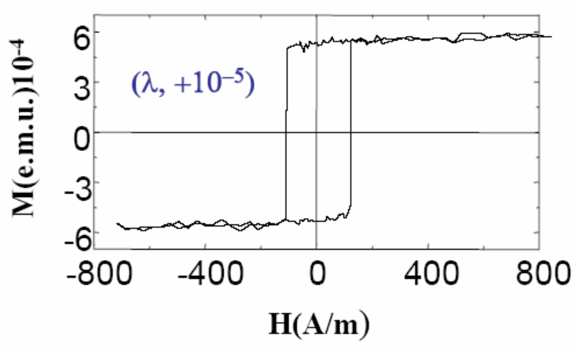

Fig.2. Rectangular hysteresis loop of the cast Fe–based microwires

3. CONCLUSION

We have stated a simple analytic expression for the switching field dependence on residual stresses, the radius of the metallic core of the microwire, magnetostriction constant and the temperature; which has been experimentally verified. The macroscopic mechanism of domain wall activation qualitatively explains the main switching field dependence as an exponential form of the temperature. (see Fig.3).

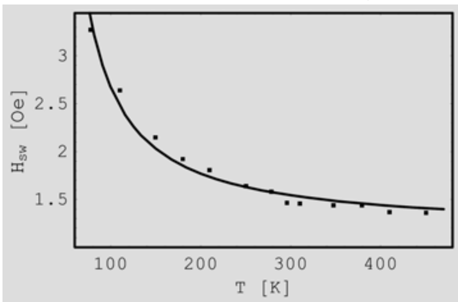

Fig.3. The theoretical curve and experimental points the switching field as function of temperature