Thermal treatment at high frequency giant magnetoimpedance in glass coated $Co_{83.2}B_{3.3}Si_{15.9}Mn_{7.6}$ microwires

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Since high frequency sources are easily available nowadays in communication electronics such as PC, cellular phone, GPS, ect, it may be necessary to operate magnetic sensor devices in corporation with those electronics at high frequency. And also, using high frequency may be more profitable for microwire due to very short penetration depth. In this study, the giant magnetoimpedance(MI) effect in high frequency range from 100MHz to 1GHz was investigated in a glass coated amorphous $Co_{83.2}B_{3.3}Si_{15.9}Mn_{7.6}$ microwire annealed at various temperatures (250℃,350℃,450℃,and 550℃ for 1hour in a vacuum). The wires were fabricated by a glass-coated melt spinning technique. A new magneto-resonance technique was used for high frequency MI measurement by forming a LC-resonator circuit consisted of a glass-coated microwire and capacitive electrodes. The measurement was carried out along the wire and at varying axial dc-magnetic field in its range of ±4000 Oe. The shape of the impedance curves plotted vs. a dc-field is changing dramatically at near the resonance frequency. The sudden change of the phase angle, as large as 180°, evidenced the occurrence of the resonance at a given intensity of the external dc-field. The maximum ratio of impedance reached in the experiment by precise tuning frequency with 100Hz resolution as much as 450,000% at the resonance frequency. This extraordinary sharp change of magneto-impedance effect can be explained in terms of a ferromagnetic resonance in an ultra-soft magnetic microwire.

References

[1] Heebok Lee, Yong-Seok Kim, and Seong-Cho Yu, J. Magnetics, 7(4), pp.160-164 (2002).