A sensitive magnetic field sensor utilizing the giant magneto-impedance effect in field-annealed co-based amorphous ribbons

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Abstract: A large giant magneto-impedance (GMI) effect was observed in Co 69Fe4Si12.B15 amorphous ribbon after it was annealed at a temperature of 450 °C for 30 min in a 10 Oe annealing field along the transverse direction of the ribbon. A maximum GMI ratio of 320% and a sensitivity of about 200%/Oe were obtained under an excitation AC current at a frequency of 10 MHz, which is helpful in the fabrication of high sensitivity magnetic sensors. Based on these excellent GMI properties, a sensitive magnetic field sensor was developed utilizing the abovementioned field-annealed amorphous ribbon as the sensing element. The performance of the sensor was tested in open-loop and closed-loop conditions. Compared with the open-loop testing, the sensor shows a better linearity of 0.59% and a larger measuring range (-2.52.5 Oe) in the closed-loop testing. The closed-loop testing also shows a sensitivity of 0.34 V/Oe compared with the sensitivity of 2.3 V/Oe in the open-loop testing. The designed sensor can be applied to detect the value and direction of geomagnetic fields, which have practical applications in geomagnetic navigation.

Author Keywords: Closed-loop; Co-Based amorphous ribbons; Field-annealing; Giant magneto-impedance (GMI); Magnetic sensor; Open-loop

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