

Giant magnetoimpedance and stressimpedance effects in annealed Co-based amorphous ribbons containing Cr

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Co-based amorphous ribbons with minor Cr additions are of considerable interest for magnetic sensing applications owing to their soft magnetic properties, high giant magnetoimpedance (GMI) ratios, and enhanced corrosion resistance. However, the influence of annealing conditions on both the GMI and stress-impedance (SI) responses across distinct microstructural states has not been systematically investigated for Cr-containing compositions.

This work reports on the evolution of magnetic hysteresis, magnetostriction, GMI, and SI in melt-spun Co-Fe-Cr-Si-B ribbons subjected to isothermal annealing at temperatures spanning from the structural relaxation regime through the onset of nanocrystallization. Hysteresis loop parameters and magnetostriction coefficients are employed to characterize the magnetic softness and magnetoelastic coupling at each stage of the thermally driven microstructural transformation. Frequency-dependent impedance measurements performed under applied magnetic field and controlled tensile stress provide quantitative assessment of the GMI ratio, field sensitivity, and stress sensitivity as functions of the annealing-induced microstructure.

The primary objective is to determine whether the partially nanocrystallized state can rival or surpass the performance of the optimally relaxed amorphous state — and to identify whether annealing conditions exist that yield simultaneously high GMI and appreciable SI sensitivity within a single material, thus offering a viable route toward dual-function magnetoimpedance sensing elements.