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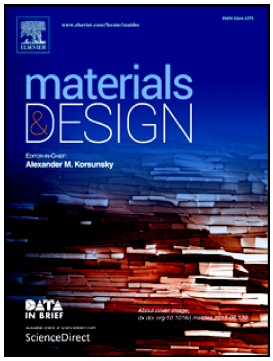

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Temperature evolution of broadband magnetization behavior in dual-phase soft magnetic compacted materials

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Abstract

This study examines the effect of operating temperature (from 23 °C to 110 °C) on broadband (from 1 Hz to 1 MHz) fluxmetrically obtained complex permeability spectra and energy loss in a set of dual-phase compacted soft magnets composed of pulverized alloys $Co_{56}Fe_{16}Zr_8B_{20}$ and $Fe_{72.5}Cu_1Nb_2Mo_2Si_{15.5}B_7$ consolidated in supercooled liquid conditions for CoFeZrB alloy constituent. The investigated samples differ in mass ratio of these two constituents (from 10 wt.% to 50 wt.% of FeCuNbMoSiB). The complete loss separation into the components produced by domain walls and magnetization rotation is performed. It is found that domain walls in such type of materials are fully relaxed beyond several kHz. Further analysis suggests that the domain wall movement is easier in materials subjected to higher temperatures as a result of reversible removal of a part of anisotropy. Nevertheless, the rotation contribution is temperature independent. In cores with lower content (10 wt.%) of FeCuNbMoSiB, temperature of 100 °C causes an increase in low-frequency (100 Hz) real permeability by 15%, while at higher amount (50 wt.%) only by 4% with respect to room temperature.

Keywords—Soft magnetic compacted material. Complex permeability. Energy loss. Temperature effect. Magnetization process. Magnetic anisotropy.

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