Enhanced GMI effect in $Fe_{73.5-x}Mn_xSi_{13.5}B_9Nb_3Cu_1$ (x = 1, 3, 5) nanocomposites clue to Mn substitution for Fe

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Abstract: Influence of Mn partial substitution for Fe on the magnetic and magnetoimpedance properties of $Fe_{73.5-x}Mn_xSi_{13.5}B_9Nb_3Cu_1$ (x = 1, 3, and 5) nanocomposite ribbons were investigated. The results indicated that the Mn addition led to an improved exchange coupling between grains and hence in the magnetic softness. Consequently, the giant magnetoimpedance (GMI) effect was significantly enhanced in these nanocomposites. In the frequency range of 0. 1-10 Mhz, the GMI ratio reached the highest values of 83%, 94%, and 130% at the frequency of 2 MHz for x = 1, 3, and 5 compositions, respectively. The corresponding field sensitivity of GMI reached the highest values of 6, 7, and 16 %/Oe, respectively. These indicate that $Fe_{73.5-x}Mn_xSi_{13.5}B_9Nb_3Cu_1$ (x = 1, 3, and 5) nanocomposites are potential candidate materials for making GMI sensors.

Author Keywords: Fe-based nanocomposite alloys; Magnetic sensors; Magnetoimpedance

Index Keywords: Fe based nanocomposite alloys; Giant magnetoimpedance (GMI); Magnetic sensors; Composition; Couplings; Iron compounds; Magnetic properties; Manganese; Natural frequencies; Nanostructured materials

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