The existence of giant magnetocaloric effect and laminar structure in $Fe_{73.5-x}Cr_xSi_{13.5}B_9Nb_3Cu_1$

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Abstract: Amorphous soft magnetic ribbons $Fe_{73.5-x}Cr_xSi_{13.5}B_9Nb_3Cu_1$ (x=1-5) have been fabricated by rapid quenching on a single copper wheel. The differential scanning calorimetry (DSC) patterns showed that the crystallization temperature of ?-Fe(Si) phase is ranging from 542 to 569 ?C, a little higher than that of pure Finemet (x=0). With the same annealing regime, the crystallization volume fraction as well as the particle size of ?-Fe(Si) crystallites decreased with increasing Cr amount substituted for Fe in studied samples. Especially, the interesting fact is that the laminar structure of heat-treated ribbons on the surface contacted to copper wheel in the fabricating process has been firstly discovered and explained to be related to the existence of Cr in studied samples. The hysteresis loop measurement indicated that there is the pinning of displacement of domain walls. The giant magnetocaloric effect (GMCE) has been found in amorphous state of the samples. After annealing, the soft magnetic properties of investigated nanocomposite materials are desirably improved.

Author Keywords: Magnetic properties of nanostructures; Magnetocaloric effect; Nanocrystalline materials; Soft magnetic amorphous system

Index Keywords: Annealing; Chromium; Crystallization; Differential scanning calorimetry; Magnetic properties; Nanostructured materials; Particle size analysis; Soft magnetic materials; Copper wheel; Laminar structure; Magnetocaloric effect; Soft magnetic amorphous system; Iron alloys

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