The crystallization and properties of alloys with Fe partly substituted by Cr and Cu fully substituted by Au in Finemet

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Abstract: The structure, crystallization and magnetic properties of ribbons obtained by first making amorphous ribbons and then objecting them to a crystallization annealing have been published elsewhere by us previously. In the present work the soft magnetic ribbons $Fe_{73.5-x}Cr_xSi_{13.5}B_9Nb_3Au_1$ (numbers indicate at.%, x = 1-5) are prepared by fast quenching on a single copper wheel. X-ray diffraction patterns show that the as-cast samples are amorphous. Differential scanning calorimetry analysis indicates that the crystallization temperature of the ?-Fe(Si) phase is a little higher than that of pure Finemet. With the same annealing conditions, the crystallization volume fraction decreases with increasing Cr content substituted for Fe. Hysteresis loops of as-cast samples measured by Permagraph show that domain walls are pinned. After appropriate annealing, the ultrasoft magnetic properties of nanocomposite materials are established. The magnetic entropy change, $|??S_m|$, of studied samples has been determined, and a giant magnetocaloric effect is found. Our materials could be considered as promising magnetic refrigerants working at high temperatures (several hundreds ?C).

Author Keywords: Magnetocaloric effect; Nanocrystalline alloy; Soft magnetic amorphous system

Index Keywords: Annealing; Chromium alloys; Copper alloys; Crystallization; Differential scanning calorimetry; Iron alloys; Magnetic properties; Quenching; Volume fraction; X ray diffraction analysis; Magnetocaloric effect; Soft magnetic amorphous system; Nanocrystalline materials; Annealing; Chromium alloys; Copper alloys; Crystallization; Differential scanning calorimetry; Iron alloys; Magnetic properties; Nanocrystalline materials; Quenching; Volume fraction; X ray diffraction analysis

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