

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 $\text{Fe}_{73.5-x}\text{Cr}_x\text{Si}_{13.5}\text{B}_9\text{Nb}_3\text{Au}_1$ (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 $\alpha\text{-Fe}(\text{Si})$ 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, $|\Delta S_m|$, 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). © 2006 Elsevier B.V. All rights reserved.

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