

Ultrasoft magnetic properties in nanocrystalline alloy Finemet with Au substituted for Cu

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Abstract: The amorphous ribbon $\text{Fe}_{73.5}\text{Si}_{13.5}\text{B}_9\text{Nb}_3\text{Au}_1$ has been prepared by rapid cooling on a copper wheel. The ribbon is 16.8 μm thick and 7 mm wide. The DSC curves show the first peak at 547-579 °C (corresponds to the crystallization of $\alpha\text{-Fe(Si)}$ phase) depending on heating rate from 10 to 50 °C/min which is a little higher than that of pure Finemet (542-570 °C, respectively). From the Kissinger plot, the crystallization activation energy is determined and shown to be 2.8 eV for $\alpha\text{-Fe(Si)}$ phase, less than that of Finemet ($E = 3.25$ eV). By annealing at 530 °C for 30, 60 and 90 min, the crystallization volume fraction of $\alpha\text{-Fe(Si)}$ phase increased from 73% to 78% and 84%, respectively. After appropriate annealing, the ultrasoft magnetic properties are achieved. The maximum magnetic entropy change, $\{\text{divides}\}\Delta S_m\{\text{divides}\}_{\text{max}}$, showed a giant value of 7.8 J/kg K which occurred at around Curie temperature of amorphous phase of the ribbon. © 2006.

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

Index Keywords: Activation energy; Annealing; Copper; Crystallization; Differential scanning calorimetry; Gold; Iron alloys; Magnetic field effects; Soft magnetic materials; Amorphous phase; Magnetocaloric effect; Nanoparticle; Soft magnetic amorphous system; Nanostructured materials

Year: 2006

Source title: Journal of Magnetism and Magnetic Materials

Volume: 304

Issue: 1

Cited by: 1

Link: [Scopus Link](#)

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ISSN: 3048853

CODEN: JMMMD

DOI: 10.1016/j.jmmm.2006.01.225

Language of Original Document: English

Abbreviated Source Title: Journal of Magnetism and Magnetic Materials

Document Type: Article

Source: Scopus

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