Influence of Fe doping and FeNi-layer thickness on the magnetic properties and GMI effect of electrodeposited Ni100-xFex/Cu (x = 0-95) wires

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Abstract: A systematic study has been performed by the influence of Fe doping and FeNi-layer thickness on the giant magnetoimpedance (GMI) effect of electrodeposited Ni100-xFex/Cu (x = 0-95) composite wires. Results obtained show that there is a correlation between the structure, soft magnetic properties and the GMI effect. Among the compositions investigated, the largest MI ratio is achieved for Ni44Fe56/Cu as a result of it having the softest magnetic property (i.e. the lowest coercivity), which arises from the smallest nanograin size. As the NiFe-layer thickness (t) increases from 1 to 27.4 nm, the GMI ratio initially increases, reaches a maximum of 110% at t = 27.4 nm and then decreases for t > 27.4 nm. Interestingly, GMI curves show a single-peak feature for wires with t < 20 nm, but a double-peak one for wires with t ≥ 20 nm. This indicates that there is a formation of a circular domain structure with a well-defined circumferential anisotropy in the NiFe magnetic layer of the wires with t ≥ 20 nm. This in turn results in a great improvement in the GMI effect of these wires. © 2008 IOP Publishing Ltd.

Index Keywords: Doping (additives); Electric wire; Electrodeposition; Iron; Magnetic properties; Nickel alloys; Thickness measurement; Circumferential anisotropy; Layer thickness; Iron alloys

Year: 2008
Source title: Journal of Physics D: Applied Physics
Volume: 41
Issue: 10
Art. No.: 105003
Link: Scopus Link
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ISSN: 223727
CODEN: JPAPB
DOI: 10.1088/0022-3727/41/10/105003
Language of Original Document: English
Abbreviated Source Title: Journal of Physics D: Applied Physics
Document Type: Article
Source: Scopus
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