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Non-contact method for stress monitoring based on stress dependence of magnetic properties of Fe-based Microwires

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Abstract

The current research describes a non-contact method for stress monitoring based on stress dependence of magnetic properties of ferromagnetic microwires as well as composites with embedded microwires. We investigated the change of various magnetic properties of Fe-based amorphous microwires under tensile stress. The amplitude of the electromotive force (EMF) signal due to the Barkhausen jumps, the saturation magnetostriction and the coercivity were studied. It was found that the dependence of the EMF amplitude on the axial tensile stress of microwire exhibits a maximum. The value of internal tensile stresses that arise during the preparation of glass-coated microwires was estimated (about 200 MPa). It was shown that a wider range of measuring stresses under the proposed method yields the use of Finemet type microwires in the amorphous-crystalline state as well as amorphous microwires without glass coating.

Keywords: magnetic glass-coated microwires, amorphous materials, soft magnetic properties, stress sensitivity

1. Introduction

Amorphous magnetic materials have been known over the past few decades owing to an unusual combination of excellent magnetic softness suitable for many applications, e.g., transformers, inductive devices, magnetic sensors as well as mechanical properties, e.g., plasticity, flexibility [1-3]. Such favorable combination of physical properties observed in amorphous materials is usually attributed to the lack of the crystalline structure and, consequently, magnetocrystalline anisotropy and inhomogeneities [3].