

Accepted Manuscript

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PII: S0304-8853(18)30814-X

DOI: <https://doi.org/10.1016/j.jmmm.2018.05.108>

Reference: MAGMA 64020

To appear in: *Journal of Magnetism and Magnetic Materials*

Received Date: 19 March 2018

Revised Date: 30 May 2018

Accepted Date: 30 May 2018

Please cite this article as: S. Atalay, V.S. Kolat, F.E. Atalay, N. Bayri, H. Kaya, T. Izgi, Magnetoelastic Sensor for Magnetic Nanoparticle Detection, *Journal of Magnetism and Magnetic Materials* (2018), doi: <https://doi.org/10.1016/j.jmmm.2018.05.108>

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Magnetoelastic Sensor for Magnetic Nanoparticle Detection

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Abstract

In this study, a magnetoelastic sensor (ME) without any coating was used to detect Fe_3O_4 magnetic nanoparticles (MNPs) for the first time in the literature. An amorphous 2605S3A ($\text{Fe}_{77}\text{Cr}_2\text{Si}_5\text{B}_{16}$) ribbon was used as an ME sensor, and samples were annealed in a furnace at 360°C for 20 minutes to improve the ME response. A frequency shift of about 320 Hz was observed at 440 A/m magnetic field with the drop of 20 μl MNPs on the surface of an amorphous ribbon. MNPs of 10, 5, and 1 μl were dripped onto the surface of the ribbon and frequency shifts of about 220, 100, and 15 Hz, respectively, were obtained. The minimum number of MNPs was measured to be about 1.1×10^9 , which corresponds to 0.025 mg or 1 μl of MNPs.

Keywords: Magnetic nanoparticles, magnetoelastic sensor, amorphous ribbon

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