# Magnetoelastic resonance in microwires for biosensors development

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A sensor based on the magnetostriction property of magnetic microwires has been developed. To optimize the sensor, an extensive characterization study has been conducted to identify the ideal qualities for enhancing its sensing capability. This research has successfully detected damage in the active material of the sensor and distinguished different media based on the magnetoelastic resonance response of the material. These results arise the way for the development of a reusable sensor capable of making real-time and wireless measurement.

*Keywords:* sensor; microwire; magnetostriction; resonance; monitoring

## 1. Introduction

The magnetic properties of microwires render them as excellent candidates for biosensor development. Specifically, the phenomenon of magnetoelasticity resonance characterized by a range of physical parameters including microwire length, magnetic field, mass, and other parameters, has demonstrated promising potential for biosensor development due to their high sensitivity and ability to perform contactless measurements [1]. For instance, these sensors have shown a significant ability to interact with a liquid medium, accurately determining the viscosity and density of the liquid [2].

## 2. Results and discussion

Various parameters affecting the magnetoelastic resonance of Fe-Nb alloys have been studied to characterize the material and identify the properties that influence this resonance, as well as the way they do so. These parameters include length, core and pyrex diameters, material state, among others [3]. In addition to this in-depth characterization, SEM and VSM measurements have been conducted to determine the optimal conditions for the development of a sensor based on the magnetostriction of the material.

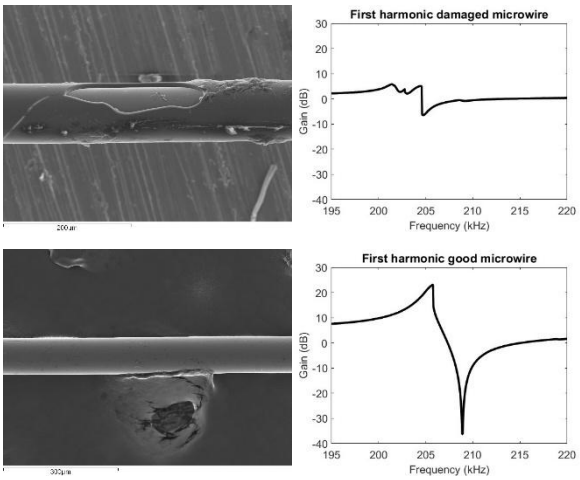


Figure 1: Top row: SEM image of a damaged microwire with its magnetoelastic resonance. Bottom row: SEM image of a microwire with its magnetoelastic resonance that is valid for sensing.

This sensor would be capable of detecting any parameter or condition that affects the magnetoelastic resonance of the microwire.

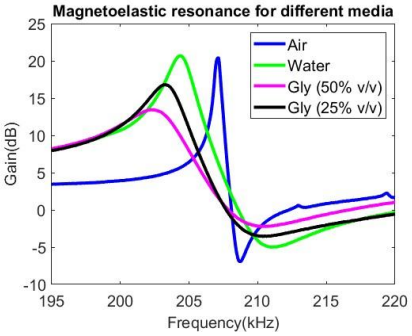


Figure 2: Detection of magnetoelastic resonance for different media detected by the developed sensor. The percentage is the fraction of volume in the mixture of water and glycerol.

Table 1. Parameters of each media used in the sensing test at 25º C.

| Media | ρ(g/mL) | μ (mPa·s) |
|---|---|---|
| Water | 0,997 | 0,89 |
| Glycerol (25% v/v) | 1,063 | 5,08 |
| Glycerol (50% v/v) | 1,129 | 29,00 |
| Glycerol | 1,261 | 945,00 |

Thus, while the magnetic properties of microwires and microwires each hold promise for separate biosensor development, their synergetic combination could lead to the creation of advanced wireless biosensors that are reusable, provide real-time measurements, are cost-effective, and eco-friendly.

## References

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