Microwire arrays as tunable electromagnetic absorber metamaterial

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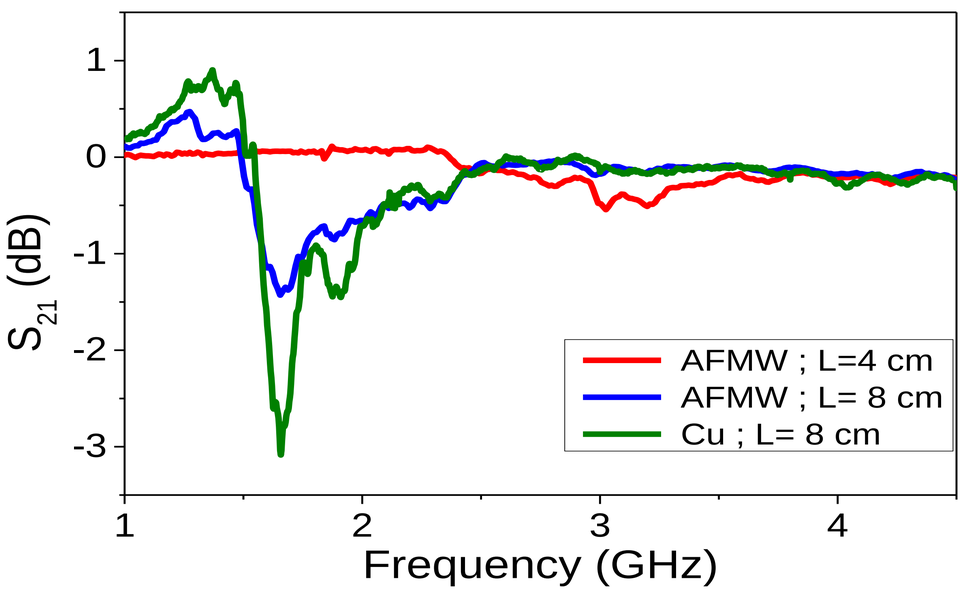
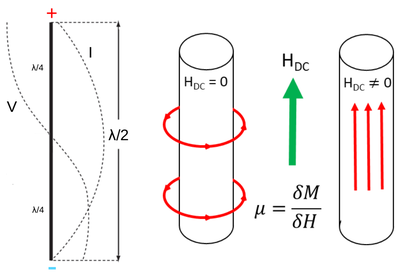
INTRODUCTION

Co-based **amorphous ferromagnetic microwires** with a core and total diameter of 31.4 µm and 49.7 µm respectively, have been placed forming an array to achieve metamaterial behavior in the GHz range. The number of the microwires forming the array have been changed in order to understand the influence of the interaction between them in the scattering parameters. In addition, the response of this **metamaterials** in the presence of an external DC magnetic field and its application as **electromagnetic absorbers** have been studied.

MICROWIRE AS A DIPOLAR ANTENNA

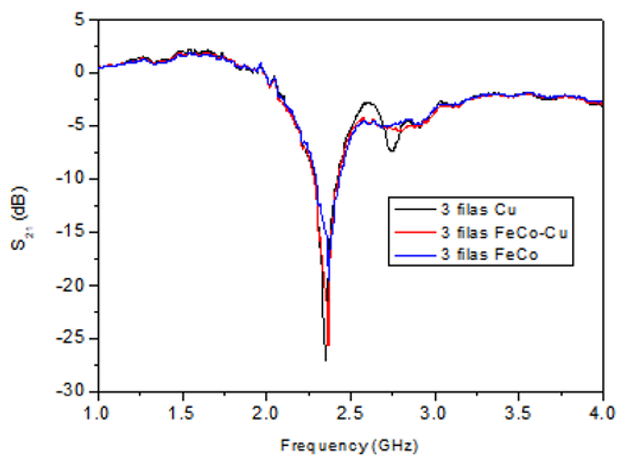
The metallic nature of microwires determines the characteristics of their interaction with **electromagnetic waves**, acting as a **dipolar antenna** and showing a dipole antenna resonance. The **magento-electrical coupling** alloys to modify the polarization with the magnetization of the wire modulated by de DC field.





$$P = \frac{j}{w}\int_{-l/2}^{l/2} i(z)dz \qquad \bar{e}_z = \varsigma_{zz}\bar{h}_\varphi$$

$$Z_i = \sqrt{\frac{\omega\mu}{2\sigma}}\frac{(1-i)J_0(\frac{(1-i)a}{\delta})}{2\pi a J_1(\frac{(1-i)a}{\delta})}$$

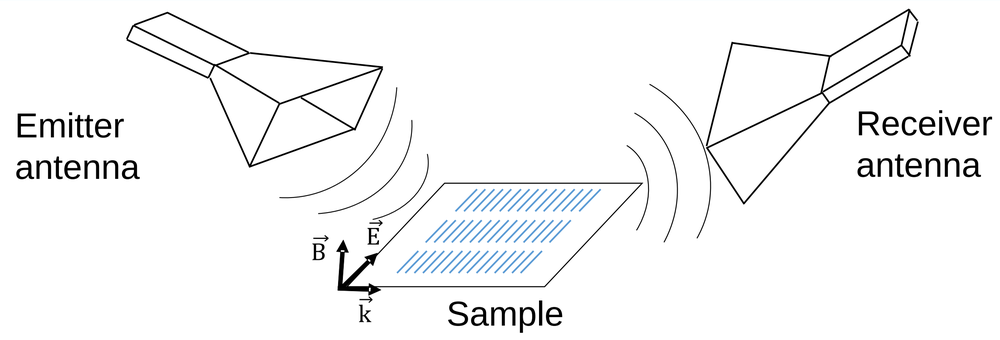


Responds to the magentic field
Improve the absorption

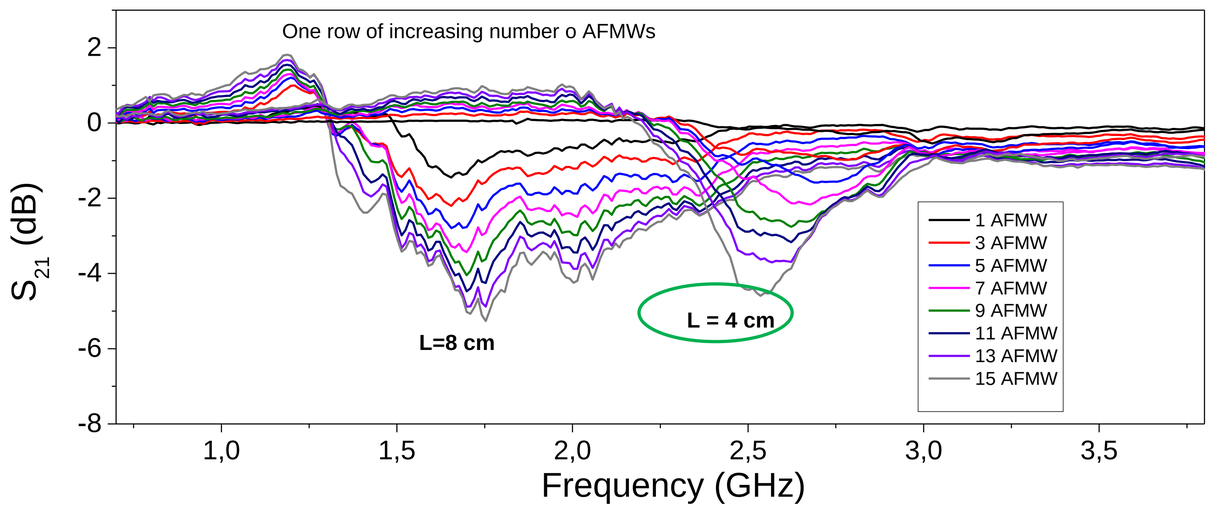
CONCLUSIONS

- Varying the **number of microwires** placed in the array we can modify the **frequency** of resonance and the **amplitude** of the scattering parameter (S_{21}) up to 50 dB for 90 microwires.
- The **scattering behavior** of the microwires is modulated by a weak DC magnetic field. As the field increases, the antenna character of microwires decreases.

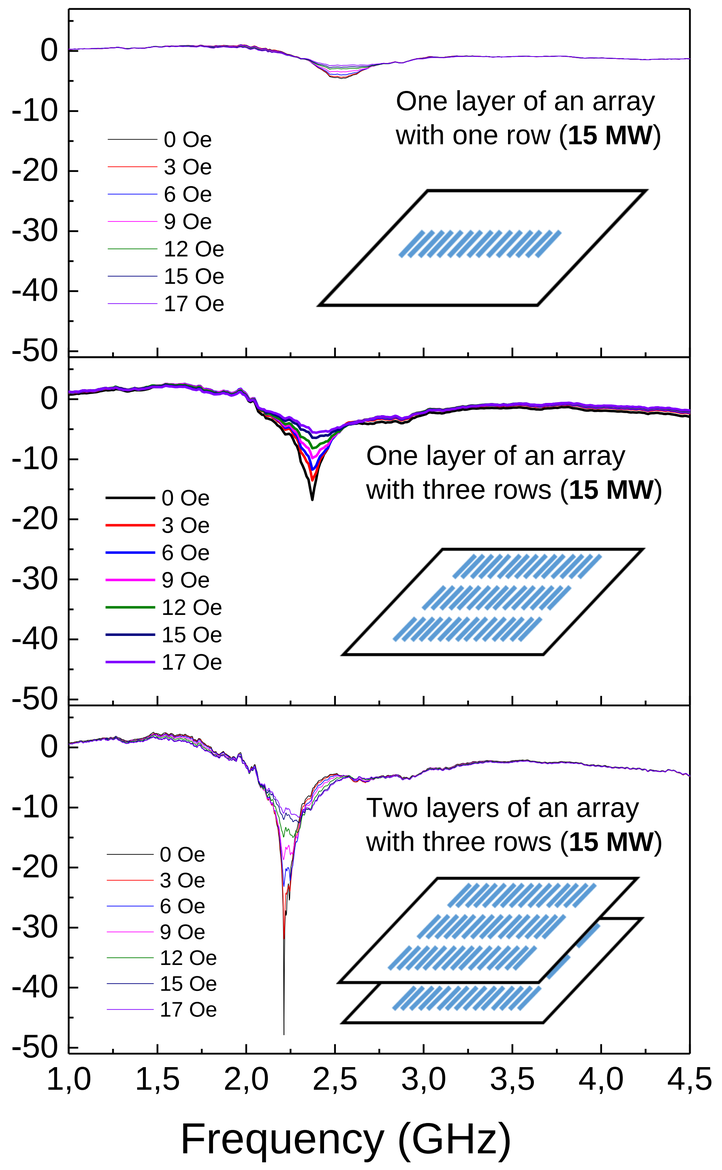
EXPERIMENTAL SET-UP



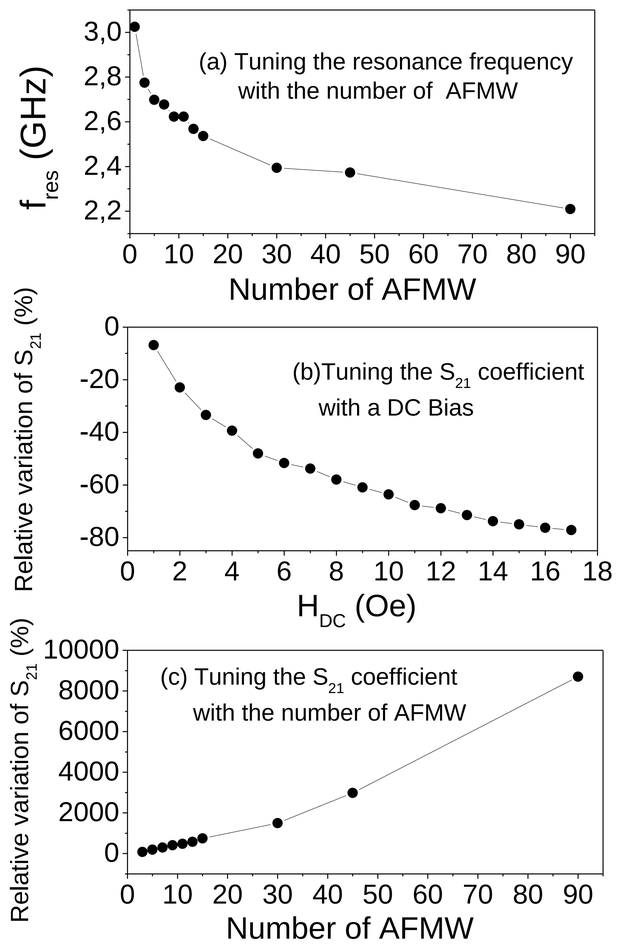
EXPEREIMENTAL RESULTS



4 cm length



Different ways to tune the absorption



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