Contribution ID: **38** Type: **Regular talk**

Cylindrical Magnetic Nanowires for Information Storage Devices

Friday 24 September 2021 15:10 (10 minutes)

The urge for more efficient memory systems at low dimensions is a current requirement for the technological development of a wide range of applications, from industrial devices to daily life appliances. Among the possible candidates, cylindrical nanowires (NWs) have already shown their potential to increase storage density [1]; however, the device design still requires a magnetic tunnel junction as the writing component [2]. Recently we have proposed a new layout of multi-segmented magnetic NW arrays that could be used as 3D racetrack memory (RM) devices without the requirement of additional components [3]. The micromagnetic simulations revealed the feasibility of using a soft magnetic layer coupled to a hard magnetic segment as the writing section of the device (Fig. 1). Introducing additional in-line hard magnetic segments separated by non-magnetic chemical constraints would allow the creation of 3D RMs with enhanced efficiencies. However, no experimental evaluations have been performed so far.
This work provides the first experimental evidence of the fabrication of 3D RM devices with incorporated writing heads along the track. Using low-cost and high-yield template-assisted electrodeposition methods [4], single and multi-segmented NW hexagonal arrays (diameters of 50 nm and interwire distances of 100 nm) of NiCu and FeCo/Au were fabricated. A throughout magnetic characterization using hysteresis loops and first-order reversal curves (FORCs) revealed that the soft segment (NiCu) induced the reversal of the hard segment (FeCo) in a two-step process, reducing its coercive and effective anisotropy fields when coupled [5]. FORC diagrams also illustrated a fingerprint typically present in soft/hard magnetic interacting bi-layered NWs, confirming the strong interface coupling.
This work was developed under the framework of project POCI-01-0145-FEDER-028676.

References
[2] S.S.P. Parkin et al., Science 320, 190 (2008).
[1] C. Bran et al., ACS Nano 12, 5932 (2018).
[3] J. Rial and M.P. Proenca, Nanomaterials 10, 2403 (2020).
[4] C.T. Sousa et al., Applied Physics Reviews 1, 031102 (2014).
[5] V. Andrade et al., submitted.

Scientific Area

Author: PROENÇA, Mariana P.

Co-authors: ANDRADE, Vivian; RIAL, Javier; CASPANI, Sofia; RIVELLES, Alejandro; PRIETO, José L.; ARAÚJO, João P.; SOUSA, Célia

Presenter: PROENÇA, Mariana P.

Session Classification: New principles and technologies for sensing

Track Classification: New principles and technologies for sensing