A novel conformal solution for magnetic field sensing based on polymer substrates

Proposers

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Introduction

More affordable and flexible sensing tools can offer new solutions for medical devices, IoT, or even disposable sensors for food safety. The progresses achieved recently in integration of functional magnetoelectronic materials on flexible and stretchable substrates inspired a realm of new devices and applications. Here, magnetoresistive sensors, being a mature technology for information storage and medical devices can provide the necessary features for a highly accurate detection of magnetic signals. However, performance can be partially degraded when patterned into non-conventional substrates. Therefore, current challenges include implementation of fabrication processes compatible with these polymer substrates, while providing the necessary shaping of the final device. The impact of a flexible/bendable sensor solutions maintains these as hot topics.

Project outline/goal

The candidate will prepare a process run-sheet with the steps needed for microfabrication of integrated sensors, adjusted to the particular materials used as substrates. The process run sheet will include test structures and validation points for microfabrication process control. Spin-valves with magnetoresistance values MR~9% and magnetic tunnel junction (TMR) sensors based on CoFeB/MgO/CoFeB stacks with MR~ 150%, and sensitivities better than ~5%/Oe will be used. The impact of substrate rigidity in sensor's performance will be assessed through evaluation of the sensor properties under mechanical bending/stretching conditions. The goal is to demonstrate a flexible device with embedded sensing and shapeable capabilities. Proof-of-concept will be done through dynamic detection of flowing magnetic droplets. This requires integration with detection and control electronics. This work is in line with the project PTDC/NAN-MAT/31688/2017.

Partner 1

The Spintronics and Magnetic Biosensors group at INESC MN has extensive experience in magnetoresistive sensing devices for industrial and biomedical applications.

Partner 2

INESC-ID groups has a vast expertise in the development and integration of electronic modules for biomedical devices.

Student profile

Profile sought: preference, but not limited, to students with a background in Physics Engineering, with an interest in Micro/Nanofabrication.