Magnetoresistive sensors with improved thermal stability

Proposers

Diana Leitao (dleitao@inesc-mn, INESC MN)

Ricardo Ferreira (ricardo.ferreira@inl.int, INL)

Introduction

Current progress in sensing technologies must meet the growing demand for precision measuring tools. Magnetic field sensors, in particular magnetoresitive (MR) sensors, offer a solution for compact and low-power consumption platforms with high sensitivity. Distinct MR-based prototypes have been demonstrated for nondestructive testing, medical diagnostics, and detection of geomagnetic field. In many situations, MR devices need to work in harsh environments (high fields, high temperatures), while keeping top performance. A key requirement to achieve this goal is improving the thermal stability of the sensor reference layer. Such groundbreaking milestone will deliver viable, reliable and robust sensing solutions for industrial, aerospace and automotive sectors.

Project outline/goal

The candidate will work on deposition of thin-films and optimization of its properties to deliver improved exchange bias field, which indicates the intensity of the magnetic interfacial coupling that fixes the orientation of the pinned layer magnetization, and the blocking temperature defined as the critical temperature at which the sensors exchange bias vanishes. Characterizations of the films using magnetic and magnetotransport properties as a function of the temperature will allow evaluation of the thermal stability. Additional magneto-optical characterization will provide further insights into the fundamentals of exchange bias, critical for further advances in this area. The optimized structures will then be include in full magnetoresistive sensor stacks comprising spin-valves or magnetic tunnel junctions.

Partner 1 – INESC-MN

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

Partner 2 – INL

INL has a vast experience in thin film materials deposition and optimization for magnetoresistive micro and nano devices.

Student profile

Profile sought: preference, but not limited, to students with a background in Physics Engineering, with an interest in magnetism and thin film deposition for senor applications.