Soutenance de thèse

VENDREDI 24 Février
14h30 - Amphithéâtre

Magneto-ionics in CoFeB systems

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Jury members

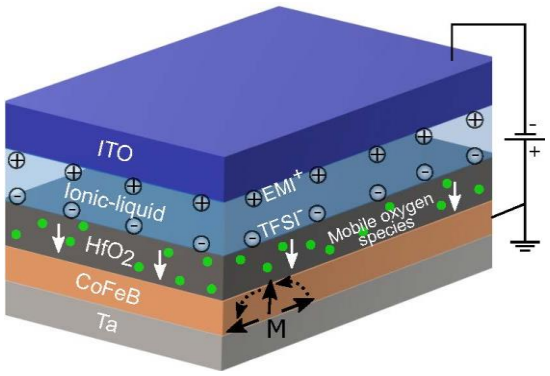
Liza Herrera-Diez : Thesis Director

Rapporteur 1 : Karin Leistner, Professeure à la Technische Universität Chemnitz, Allemagne. (Externe à l'UPSaclay, pas de publications communes avec le candidat)
Rapporteur 2 : Reinoud Lavrijsen, Professeur à la Eindhoven University of Technology, Les Pays-Bas.

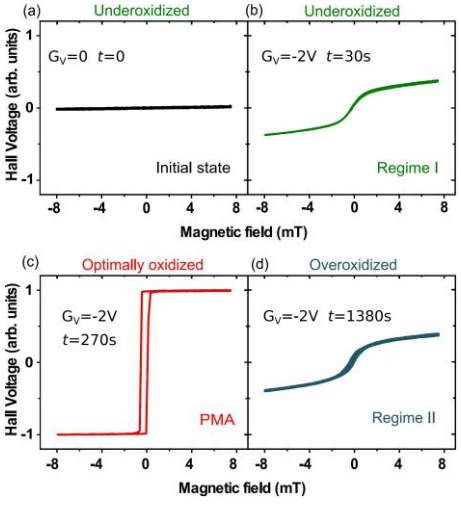
Examinateur 1 et Présidente du jury : Julie Grollier, Directrice de recherche CNRS à l'UMR CNRS-Thales, Palaiseau, France. (UPSaclay)
Examinateur 2 : Eva Pellicer, Professeure à la Universidad Autonoma de Barcelona, Espagne.
Examinateur 3 : Shimpei Ono, Chercheur au CRIEPI, Japon, et lauréat de la chaire d'Alembert de l'UPSaclay pour 'chercheur confirmé'.
Examinateur 4 : Mohamed Belmeguenai, Maître de conference HDR à l'Université Sorbonne Paris Nord

Abstract

Electric field control of magnetic properties in ferromagnetic thin films is a sought-after feature for spintronics devices, as it offers great potential for high energy efficiency in memory applications.
Much like the power efficiency, two other sought-after features to incorporate are nonvolatility and reversibility. In addition to the effects arising from electric field-induced charge accumulation at the ferromagnet/dielectric interface, electric field-induced migration of ions in dielectric layers adjacent to a magnetic layer shows a more extended effect, resolving electrostatic screening and volatility of charges. Such a technique is known as magneto-ionics. Magneto-ionic control of magnetic properties using oxygen ions has been of great importance in developing energy efficient spintronics devices; however, the magneto-ionic performance such as speed, reversibility and stability is largely influenced by the stack materials. In this thesis, CoFeB-based systems are explored for various heavy metal buffer layers optimizing magneto-ionic performance addressing the importance of factors such as the level of oxidation, post-growth annealing and the stability.



Graphic representation of the Ta/CoFeB/HfO2 magnetoionic stack covered with the ionic liquid [EMI]+[TFSI]− gate. The gate voltage induces the motion of oxygen species in HfO2



A progressive oxidation is induced upon exposure to a gate voltage GV = −2 V. Different exposure times t drive the system from IPA (a, initial state) through regime I (b) into PMA (c) and back to IPA through regime II (d).