Centre de Nanosciences et de Nanotechnologies

Soutenance de thèse

Mardi 03 juillet 2018

14 h 00

Salle 44 (P. Grivet) C2N site Orsay

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« Edge driven magnetic switching in CoFeB-MgO Based spintronic nanodevices»

Composition du jury proposé

Gilles Gaudin Directeur de recherche CNRS, Grenoble	Rapporteur
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Abstract

This thesis focuses on the influence of edge damages introduced by the patterning process on the magnetic switching of spintronics nanodevices. Two typical magnetic switching have been investigated: (i) field-induced switching in magnetic nanodots with perpendicular magnetic anisotropy (PMA) and (ii) current-induced switching in Magnetic Tunnel Junctions (MTJ) with in-plane magnetization. Along this line, we first have developed the full nanofabrication process for both magnetic nanodots down to 400 nm and MTJ nanopillars down to 100 nm using conventional electron beam lithography, ion beam etching and lift-off approach. By studying the switching field distribution (SFD) of magnetic nanodots using Kerr image microscopy, we show that the magnetization reversal is dominated by the nucleation and pinning of Domain Walls (DWs) at the edges of the nanodots due to the damages induced by the patterning process. For MTJ nanopillars, we show that by using SiO_2-based insulator material for encapsulation, unexpected resistive Si filaments are formed at the edges of the MTJ. These Si filaments exhibit resistive switching, which allows us to demonstrate for the first time a heterogeneous memristive device, namely resistively enhanced MTJ (Re-MTJ) that combines magnetic and resistive switching. We discuss the potential application for Re-MTJ as a logic-in-memory device with memory encryption function.