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"Magnetoresistive Devices with Perpendicular Magnetic Anisotropy for Future Memory and Data Storage Applications"

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The spin-torque-transfer effect at nano-magnetic devices with perpendicular magnetic anisotropy (PMA) has attracted extensive interest, fueled by its promising advantages towards high density Magnetoresistive Random Access Memory (MRAM) and the spin-torque oscillator for the Microwave Assisted Magnetic Recording (MAMR) application. In this talk, we present well-defined magnetization switching at two different types of magnetoresistive devices, magnetic tunnel junction (MTJ) and giant magnetoresistance (GMR) spin-valve devices, composed of Co/Pt multilayer electrodes with PMA. To be integrated into the magnetoresistive devices, Co/Pt multilayer films have been optimized in terms of good fcc (111) texture, reduced roughness, and narrow switching field distribution. Focusing on obtaining highly spin-polarized current, relatively thick Co adjacent layers have been adopted. It is observed that the resistance change from the spin-torque induced magnetization switching is well matched with that from the external field induced switching in the perpendicular magnetoresistive devices. The critical current density obtained is comparable to the value obtained in the previous research using Co/Ni multilayers, indicating that increasing the thickness of Co adjacent layers is effective to obtain highly spin-polarized current. This talk will also highlight the recent experimental results on the spin-torque induced magnetization precession. For investigating the promise of the MAMR, we integrate the spin-torque oscillator devices by combining the analyzer and oscillating layers on top of the perpendicular polarizer. As a result, the detectible out-of-plane magnetization precession of the oscillating layer is observed in which the precessional frequency can be tuneable by spin-polarized current.

Jeong-Heon received his Master degree in Chemistry and Bachelor degree in Chemistry Education from Seoul National University, South Korea in 1999 and 1997, respectively. He worked as a senior engineer in the Semiconductor R&D Center in Samsung Electronics from 1999 to 2005. He received his Master degree in Materials Science and Engineering from Carnegie Mellon University in 2007. He is currently a Ph.D. candidate under the guidance of Prof. Zhu.