Abstract Submitted
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The Electric, Magnetic, and Optical Characterization of Permalloy Oxide Grown by Dual-Ion Beam Sputtering[1] MACLYN COMPTON, ELIZABETH LEBLANC, WILHELMUS GEERTS, NELSON SIMPSON, Department of Physics Texas State University, MICHAEL ROBINSON, Department of Electrical Engineering Texas State University — Permalloy ($Ni_{80}Fe_{20}$) is a commonly used soft magnetic material in magnetic reading heads. Its magnetic properties do not depend on stress, a parameter difficult to control in thin film devices. Permalloy Oxide (PyO) on the other hand, has a high resistivity ($>4{\cdot}10^3\Omega$ cm), is anti-ferromagnetic and has recently been shown to strongly enhance the performance of lateral spin valve devices. Historically, the oxidation of permalloy has been seen as a defect that should be avoided by appropriate encapsulation and very little is known on its electric and optical properties. We deposited thin PyO films by Dual Ion Beam Sputtering (DIBS) at room temperature on various substrates. Van der Pauw and Hall measurements were carried out from 77K to 400K and at magnetic fields up to 9T in order to determine its electronic bandgap, resistivity, free carrier concentration, and its mobility. The dielectric properties and defects were studied using a CV-setup and an impedance analyzer. Magnetic measurements were conducted on a Quantum Design PPMS VSM to determine the state of oxidation. Optical properties were measured by a M2000 Woollam variable angle spectroscopic ellipsometer. These properties were used to determine film thickness, bandgap and the optical constants of PyO.

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