Effects of preparation conditions on the physical properties of nickel ferrite thin films

HILLARY BELLIVEAU, MANUEL BONILLA, PATRICK MCARDLE, CASEY MILLER, Univ of South Florida — The effects of the deposition temperature, pressure, and oxygen partial pressure were investigated on the structural, electrical, and magnetic properties of nickel ferrite (NiFe$_2$O$_4$) thin films grown by magnetron sputtering. The samples were grown on Si (100), Si (100) with 500nm of amorphous SiO$_2$, and on MgO (100) substrates. Increasing the deposition temperature allowed the NiFe$_2$O$_4$ (004) XRD peak to appear at higher oxygen partial pressures. Between films of the same oxygen pressure, increasing the deposition temperature reduced the FWHM and increased the intensity of the NiFe$_2$O$_4$ (004) XRD peak. The films were 800 to 1000nm thick as measured by profilometry. Increasing the oxygen partial pressure reduces the intensity of the (004) NiFe$_2$O$_4$ XRD peak, and allows us to tune the material from a conducting material (rho = 114 microOhm*cm at T=220K) to an insulating one (rho= 2475 Ohm*cm at T=220K). The resistivity at 220K decreased as the deposition temperature was increased for films grown at the same oxygen partial pressure. The magnetic properties were investigated with magneto-optical Kerr effect and vibrating sample magnetometry.

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