*Electrodeposition and Characterization of Thin Films Created for Giant Magnetoresistance*

Nicholas R. Wozniak, Alyssa Frey, and Jennifer Hampton

University of Wisconsin-Eau Claire and Dept. of Physics, Hope College

The phenomenon of giant magnetoresistance (GMR) occurs when a non-magnetic thin film is sandwiched between two magnetic films. In the presence of an external magnetic field, the magnetic films align, allowing increased current flow. Electrodeposition was used to create these films necessary for GMR. The magnetic films were composed of nickel and iron while the non-magnetic films were composed of copper. These films were deposited from sulfate solutions containing nickel (100mM), iron (10mM), and copper (1mM) onto gold-plated silicon wafers. Particle induced x-ray emission (PIXE) and atomic force microscopy (AFM) were used to study how the deposition time (either 6 or 60 minutes) and deposition potential (ranging from -500mV to -1200mV vs. Ag/AgCl) affect the composition and surface roughness of the deposits. PIXE analysis showed that, at less negative potentials, the deposit is dominated by copper, and as the potential becomes more negative, the deposit has a greater nickel and iron concentration. PIXE also revealed that the ratio of iron to total magnetic material changes with varying potential and reaches a maximum value at -900mV. Analysis of RMS roughness from the AFM data for varying length scales reveals the fractal nature of the deposits below a characteristic length.

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