Isidore LaRocco (zdn5uf)

Summary Report

ECE 4907 ECE Research Projects

Spring 2026

Original Scope:

1) Erase data from the storage layer of discarded hard drive disks (HDDs).
2) Recover materials from the HDD components including nickel, aluminum, and neodymium.

Laboratory Procedures and Tools:

Material Sourcing

Identified methods for obtaining discarded Seagate and Western Digital HDDs including contact with various UVA departments. Followed recommendation to source from eBay and communicated with graduate student mentor for best practices.

HDD Disassembly

Wrote step-by-step instructions for removing the HDD platter and header magnet based on YouTube video demonstrations. Used proper handling procedures for experiment samples including latex gloves and tweezers.

Laser Safety and Usage

Learned about laser equipment safety and practiced safe operation while in the lab. Used the 1064 nm laser for numerous experiments requiring practice with focusing the laser, configuring EZCad for needs of the experiment, and setting up optical hardware for consistent trial results. Additionally, practiced various laser ablation techniques including underwater ablation, out-of-focus ablation, and removal of ablated material from the ablation zone using a small fan.

Microscope Imaging

Used the lab's compound microscope and NMCF's Hirox microscope to take pictures of samples. Observed various results of laser ablation including surface roughness and depth of ablation. This included using various zoom, lighting, and labels on the lab microscope as well as learning the Hirox software to take 2D and 3D images.

LIBS Analysis

Performed LIBS analysis using the 1064 nm laser and AvaSpec-Mini LIBS. This required gaining background knowledge of LIBS spectrometry as well as learning AvaSoft software configuration.

Data Analysis and Visualization

Compared and contrasted data to draw hypotheses based on my results and relevant literature. Created graphs to demonstrate intermediate results. Prepared and presented intermediate results during weekly lab meetings.

Example Figures:

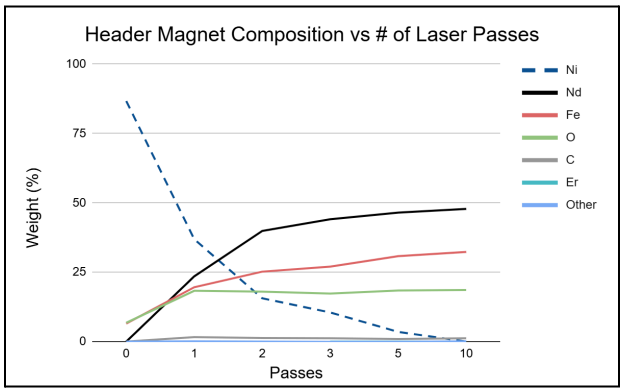

Figure 1. Results for HDD magnet EDS analysis.

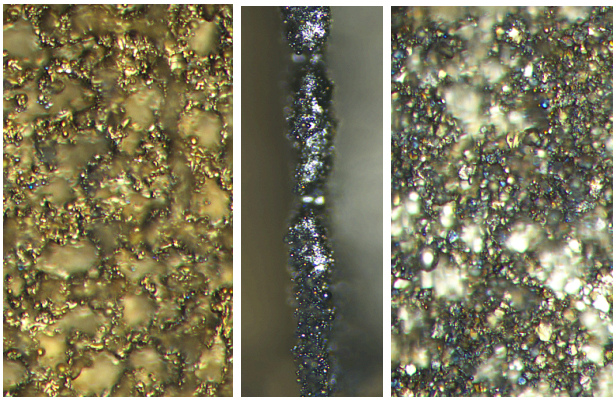

Figure 2. Comparison of normal surface, cross section, and ablated surface of HDD magnet nickel coating (left to right).

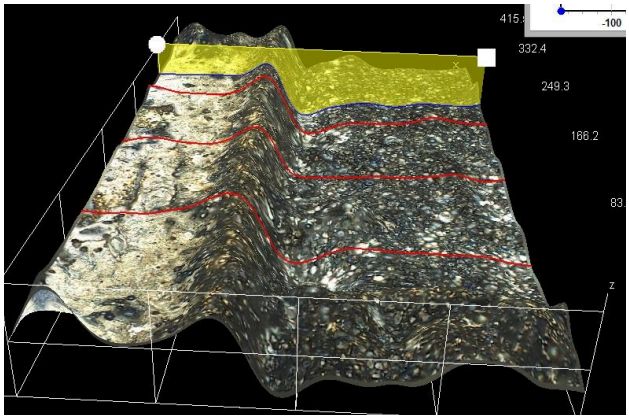

Figure 3. Measurement of ablation depth for HDD header magnet using the Hirox microscope.

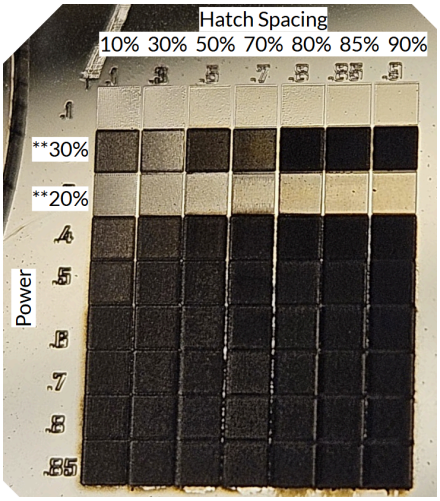

Figure 4. Experimental setup for ablating HDD platter with varying power and hatch spacing.

Experimental Results:

- Demonstrated consistent removal of nickel coating from HDD header magnet up to 100% removal using a 1064 nm laser at 10% power.
- Performed low-resolution analysis of HDD platter material composition using LIBS.

Outreach:

- Sent outreach emails to 19 potential backers across the DoD, industry, and UVA in the interest of submitting a proposal to the National Defense Stockpile program for HDD header magnet REE recovery.