Multi-Metal Selective Laser Melting - Material Recovery

Overview
Multi-metal 3D printing creates a mixture of leftover powder that is not used during the print process. Without an effective recovery system, the powder mixture becomes waste. The ability to recycle the mixture into the original powders can save money and prove the usefulness of multi-metal 3D printing.

Objectives
The team focused on producing a viable recycling system with the following objectives:
1. Test the previous team’s prototype to determine the current purity of separated powders
2. Refine the first separation stage of removing stainless steel to enable the upscaling of the prototype
3. Further develop the second phase of the prototype which involves separating the remaining Inconel and copper alloy powders

Approach
- At the start of the project the team gathered customer needs to determine where the majority of time and effort would be focused on
- Research on relevant patents and technologies to separate powders yielded no current methods of separation for our specific powders
- Concept generation gave the team options for the second phase separation
- Testing was conducted at the Materials Characterization Lab (MCL) in the Millennium Science Complex using x-ray diffraction
- Based on the data, new design changes were implemented to increase efficiency of prototype
- A second round of test samples were sent to the MCL to determine new purity of separated powders

Outcome
- After the design changes, a purity of 97.1% for the stainless steel was obtained allowing for future upscaling of the first phase
- Testing at the MCL saved ~$3,000 when compared to the quote that the Westmoreland Lab had given the team
- Data on the purity of the Inconel and copper alloys after the second phase separation led to recommendations given to X Material Processing on methods to improve the efficiency of the second stage