X Material Processing Multi-Metal 3D Printing – Material Recovery

Overview
XMP developed a process of Selective Laser Melting which allows users to print with multiple different metals: Stainless Steel 17-4PH, Inconel 718, and Copper. Their current process produces a considerable amount of waste and scrap of expensive powder. XMP wants to create a recycling system capable of sorting the scrap powder into their respective elements.

Objectives
• Separate Inconel 718, Stainless Steel 17-4PH, and Copper powders to a level of purity that they can be reused
• Scale the current first phase of the process from 3 g/min to 1 kg/min while maintaining a compact design
• Generate a method for effectively separating the Inconel and Copper powders in Phase 2

Approach
• Conduct preliminary research to determine what previous capstone groups did
• Develop design alternatives for phase 2 using material properties such as density, electric conductivity, and magnetism
• Meet with sponsor to determine most important design characteristics
• Utilize concept selection matrix to determine best phase 2 design
• Create CAD model of phase 1 scaled design
• Create CAD model of phase 2 design
• Develop parts list for both phases and order parts
• Fabricate phase 1 prototype
• Fabricate phase 2 prototype
• Develop testing procedure and safety methods

Outcomes
• Throughput for the separation of stainless steel was increased by ~1870% from 3g/min to 5.62 kg/min.
• Developed a proof of concept prototype that utilized liquid argon to cool Inconel to its Curie temperature of -170 °F and temporarily induce magnetism to separate it from the copper powder