

Microstructure Optimization of Metal Binder Jetting Components Through Sintering and Rapid Cooling Treatments

Imagine going to the supermarket to buy your favorite Swiss cheese, everyone would like to grab the cheese with the least holes to enjoy as much cheese as you can get per pack.

This project has many dimensions starting from reducing the Co2 emissions which aid in pollution and global warming, think about all your old gadgets and old appliances and even your scrapped grandfather's car going to scrap yard, we tend to find a way to integrate this material back into continuous cycle by converting them (after sorting) into small sand size particles, then we take those sand particles and glue them together producing new metal products.

In order to produce a product that can serve for long and extended periods, we need to make this printed parts compact, think of a metal cooking pan, the denser this pan the more robust, scratch and dent resistant.

We tested different packing methods to reduce the distance between those material particles either by design or by heating this particle to weld it and eliminate the gasses trapped between them, we also tried to increase this temperature while reducing the atm. pressure to help extracting any gasses between those particles on some trials.

We tested this process in different temperature to see which temperature will give us the best results but keeping in mind that increasing this temperature can burn this final pan shape when packed in a high temperature leading to changing its rounded shapes due to melting.

Other step in this process is how to cool it when we take out from the oven, quick cooling can give us a stiff product but brittle as glass when drops, while slow cooling will give us a less strength but can withstand multiple hits and drops.

We were able to achieve better dense products by 7.7% more than any produced with such material before opening the door to recycle more waste material. Those products can be used in aerospace spare-parts and various corrosive environments.

Finally, it is all about finding the optimum packing and cooling temperature that can allow you to produce a robust product while preserving its original dimension.