

Sintering Powders



Sintering Powders include two groups: Refractory Ballast and Sintering Carbon

Refractory Ballast

The purpose of these materials is to support the part shape during debinding and sintering. It also helps the binder leave the print during debinding.

[Al2O3](#) is used during debind for [Copper](#) and [Bronze](#). Properties that make it great for this process:

- It's porous, so gasses can escape.
- It's an excellent conductor of heat. This helps distribute heat evenly around the part during debind.
- It's quite massive by volume. A key flaw that people experience during debind is 'pillowing'. This is when the prints partially delaminate. They will literally look 'puffed up' or 'inflated'. By burying the print in Al2O3, its weight will hold the print in place and prevent pillowing. You can also overcome pillowing by debinding very, very slowly. However, burying in Al2O3 lets you debind many times faster.

[Magnesium Silicate](#) is used during sintering for Copper and Bronze. This material works great for this process because it is very lightweight and has high lubricity. As the print is shrinking and densifying, the ballast will move out of the way, letting it shrink without causing cracks.

The copper alloys are strong enough after debind that you can handle them. They are held together by an atomically thin layer of oxide that reduces during the Sinter cycle. Our [published recipe](#) has you remove the print from the Al2O3 ballast and move it to a crucible with Magnesium Silicate ballast. Moving your part from one ballast to another takes most of the residual carbon from the debind out of your process. In fact, if you don't do this step with the copper alloys the sinter is more likely to fail. The part may come out crumbly and black, or only the outside will sinter properly. So with non-steel, it's the act of removing the part from the Al2O3 that removes the residual carbon from the sinter process.



[Steel Blend](#) is used for debinding and sintering steel and iron.

Part of the challenge with the Steels is that it's impossible to handle a 'brown' steel or iron part. Once you remove the binder, the part has no structural integrity. If you touch it, it will just crumble. The current operating hypothesis is that the graphite that's added to the Al₂O₃ in the Steel Blend prevents the residual carbon in the debind stage from accumulating around the part. While both pure carbon and graphite are allotropes of the same element, they behave very differently chemically.

So, the reason Steel Blend lets you debind/sinter steel in a single step is that graphite. If you try to sinter Steel in just Al₂O₃, you will sometimes succeed, but other times you will get the same symptom as the copper alloys if you don't swap the binder. They will either be black and crumbly, or only the outside layer will sinter.

Furthermore, the graphite adds lubricity to the ballast. This lets it yield to your part as it shrinks and densifies.

Sintering Carbon

[Sintering Carbon](#) acts as an oxygen getter during the sintering process and prevents oxygen from reaching your print and oxidizing it. Apply a layer to the top of your packed crucible.



Print and Sinter Kits

The [Print and Sinter Kits](#) in [The Virtual Foundry shop](#) ensure you're getting the right Sintering Powders for your Filamet™ material.

Can the Sintering Powders be Reused?

Yes! They all can.

Refractory Ballasts will change color over time so should be refreshed after many cycles.

The graphite in Steel Blend will slowly disappear. Either replenish the graphite or begin again with fresh Steel Blend.

Use fresh ballast when you want to reduce the variables in your process.

Any amount of Sintering Carbon that comes out of the sintering cycle fully black like it started can be filtered out and reused. The Sintering Carbon will eventually be used up - it is meant to be consumed.

Slow the rate of consumption by covering your crucible with [Kiln Paper](#), a ceramic plate or other kind of lid. Be sure your cover does not create a seal - air must still be able to move around.

Watch: FAQ: [Can the Sintering Powders be Reused?](#)

Can Alternative Powders be Used?

Yes. Source materials with the same properties as those listed above. Make sure they will not be affected by the temperatures you will be using.