

Currently, We Know...

- Copper filled polylactic acid (PLA) can be used in Fused Filament Fabrication (FFF) 3D printing
- Multi-step AM processes are timeconsuming, costly, and requires specialized equipment

Previous Research

Identified...

- Sintering complex parts very difficult due to volumetric shrinkage and potential warping
- 3D scanning can be utilized to account for volumetric shrinkage

We Want to Know...

Is the sintering process essential for achieving successful ballistic performance from 3D printed copper projectiles

WE FOUND THAT...

- Sintered slugs experienced significant mass lost (77%) due to high porousness compared to lead and green slugs (4% and 3%)
- Oxidation can occur during sintering process
- Bypassing sintering process presents opportunity for unique ballistic geometries that could help in flight stabilization and prototyping

NOW WE WANT TO...

- Characterize sintering process to minimize porousness and warping within the material
- Test low caliber small arm rounds to determine effects on projectile when introduced to direct heat and pressure
- Laser surface center rounds to achieve required tolerances for projectile

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- removes PLA from green 3D printed part creating 'brown" part
- through sintering metal into fully





Effects of the Sintering Process on Additively Manufactured Copper Projectiles

Avery Lyons¹, Phillip Mulligan¹ ¹Mechanical Engineering Department, Missouri University of Science and Technology



3D printed 12-gauge slugs with Virtual Foundry's copper filament to examine if the sintering process is necessary for slug survivability. The test indicated the sintering process is not necessary for the slug to survive firing from a 12-gauge shotgun. The tests also highlighted the sensitivity of the sintering process to oxidation of the copper slugs

