3D-printing and consolidation of 316L stainless steel powder components

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OVERVIEW

ABSTRACT
A unique binder jetting method is employed in printing 316L stainless steel components with the aim of improving both the green density of printed parts and subsequently sintered components. In this method, a water-soluble binder is premixed with 316L stainless steel powder before printing. During printing, water is jetted unto the powder/binder mixture to selectively activate the binder, layer by layer. The effects of printing parameters on the green density and sintered components are investigated. Results show that layer height and nozzle temp affect the density and dimensional accuracy of the green compact. Results show that on reducing layer height, green density increases. However, the dimensional accuracy of the printed samples decreases, especially in the Z-direction.

3D Printing (Binder Jetting) / Sintering

Processing steps
- Metal Powder
- Powder/Binder ratio optimization
- Printing optimization
- 3-D Printed Complex Parts
- Debinding optimization
- Sintering optimization

Sintering of 3-D Printed SS 316L Samples

Before Debinding optimization for oxidation
- Sintering Temperature (°C) Relative Density
  - 1250 38.99%
  - 1320 38.88%
  - 1360 70.08%
  - 1380 65.64%
  - 1400 73.16%

After Debinding optimization for oxidation

Optimization of 3-D printing of green parts
- Consideration of green density and geometric accuracy

Optimization of debinding for SS316L green parts
- Oxidation consideration

Print parameters
- Z-level Home: 2.5
- Water temp: 50
- Roller speed: 70
- Shaking speed: 60

Layer height: 200

References