3D-PRINTING VIA BINDER JETTING AND CONSOLIDATION OF NANO ALUMINA BONE SCAFFOLD PROTOTYPES
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ABSTRACT

Main problems with current bone grafting and replacement methods:
• Inability to tailor the shape of the graft to match the injury site or patient
• Inability to produce a porous structure with high mechanical strength

Results using binder jetting provided in this study:
• Novel nano-powder coating procedure
• A cubic 70% dense sample with strength of 186 MPa
• A complex scaffold shape with strength of 28 MPa

RESULTS & CONCLUSION

Complex Alumina Structures were produced with properties that mimic bone
• The highest density achieved was 70% in the cubic sample
• The final grain size is ~5um, impossible with micron sized powders

FUTURE WORK

Using the constitutive sintering equation, it was determined that in order to get close to full density in this material it would take 9 days of sintering
• Try different materials; hydroxyapatite
• Try different polymer for the powder preparation process
• Optimize the sintering cycle
• Try different sintering techniques
• Expand model-based prediction tool

BIBLIOGRAPHY


Bone Type | Cortical | Cancellous
---|---|---
Compressive Strength | 100-230 MPa | 2-12 MPa
Porosity | 3-12% | 50-90%

Patent pending on powder preparation process

Material: Alumina, Al₂O₃
Alumina was chosen for its biocompatibility as well as its availability in various particle shapes and sizes for printing

Materials & Methods

Current Sources of Bonegrafts

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