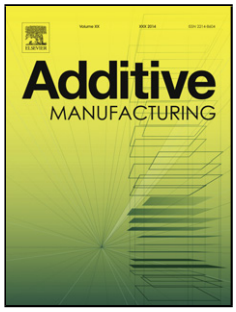

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PII: S2214-8604(14)00029-3
DOI: http://dx.doi.org/doi:10.1016/j.addma.2014.12.005
Reference: ADDMA 22

To appear in:

Received date: 7-5-2014
Revised date: 24-10-2014
Accepted date: 11-12-2014

Please cite this article as: Fish S, Booth JC, Kubiak ST, Wroe WW, Bryant AD, Moser DR, Beaman JJ, Design and Subsystem Development of a High Temperature Selective Laser Sintering Machine for Enhanced Process Monitoring and Control, *Addit Manuf* (2014), http://dx.doi.org/10.1016/j.addma.2014.12.005

Design and Subsystem Development of a High Temperature Selective Laser Sintering Machine for Enhanced Process Monitoring and Control

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Abstract

As Additive Manufacturing (AM) adoption grows, the demand for improved quality output product is increasing. This is evident in the desire for both increased repeatability and higher strength and ductility in Selective Laser Sintered (SLS®) Polymer parts. One approach to expanding the performance envelope for polymers in this domain is through high temperature manufacturing processes, supporting the use of polymers with increased mechanical strength, lighter weight, and a favorable ability to sterilize for medical applications. Early candidate materials that exhibit higher melting and glass transition temperatures include the Polyether Ether Keytone (PEEK) and Polyaryletherketone (PAEK) family of materials. This paper describes the design of a laboratory SLS® machine for operation with these and other similar materials, emphasizing its thermal and operational design features. Data is also provided from initial testing of key subsystems during assembly and prior to full system operation. Because this machine is intended to explore processing new materials, it also incorporates features for improving the data collection, and associated feedback control for improved repeatability, and ultimately defect detection and mitigation during the Additive Manufacturing.

Keywords: Selective Laser Sintering, High Temperature Powder Polymer, Selective Laser Melting, Process Control, Machine Design, Thermal Control

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