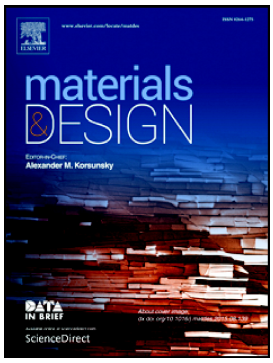
Accepted Manuscript



Static behavior of lattice structures produced via direct metal laser sintering technology

Vincenzo Crupi, Emre Kara, Gabriella Epasto, Eugenio Guglielmino, Halil Aykul

PII: S0264-1275(17)30840-7
DOI: doi: 10.1016/j.matdes.2017.09.003
Reference: JMADE 3336

To appear in: *Materials & Design*

Received date: 16 May 2017
Revised date: 5 August 2017
Accepted date: 3 September 2017

Please cite this article as: Vincenzo Crupi, Emre Kara, Gabriella Epasto, Eugenio Guglielmino, Halil Aykul , Static behavior of lattice structures produced via direct metal laser sintering technology, *Materials & Design* (2017), doi: 10.1016/j.matdes.2017.09.003

Static behaviour of lattice structures produced via direct metal laser sintering technology

Vincenzo Crupi[1], Emre Kara[2], Gabriella Epasto[1], Eugenio Guglielmino[1] and Halil Aykul[2]

[1]Department of Engineering, University of Messina, Messina, Italy

[2]Department of Mechanical Engineering, Hitit University, Çorum, Turkey

ABSTRACT: The aim of this scientific work was the analysis of the micro lattice structures under uniaxial quasi-static compression loading with regard to the effect of unit cell size and strut diameter. A wide range of cubic lattice blocks designed in a CAD software were fabricated using Ti6Al4V (Ti64) metal powder and two different production parameters in the Direct Metal Laser Sintering machine. The failure modes of the specimens were investigated and the 3D Computed Tomography system was used for the morphological analysis of the structs. An analytical model, developed by Gibson and Ashby, was adapted to the titanium body centered cubic lattices in order to predict their mechanical properties for compressive loading. Moreover, the compressive responses of the lattice structures were also studied using a numerical approach based on finite element analysis. Both experimental and theoretical results presented good agreement in terms of mechanical properties of the body centered cubic lattices and showed that such structures are great energy absorbers. Theoretical approaches gave significant results on the predictions of mechanical properties of these cellular structures, which are suitable for biomedical and transport engineering applications, in order to save manufacturing cost and time.

KEYWORDS: Micro lattice structures, Direct Metal Laser Sintering, Lightweight structures, Computed tomography, Finite Element Analysis.