

Compression behaviors of 3D printed pyramidal lattice truss composite structures

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1 **Compression behaviors of 3D printed pyramidal lattice truss**

2 **composite structures**

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8 **Abstract:** The lattice truss structure is a porous lightweight periodic structure with high
9 specific stiffness and specific strength. In this research, pyramid lattice truss structures
10 were designed and manufactured by three-dimensional (3D) printing technology
11 through horizontal printing and vertical printing manners, respectively. Quasi-static
12 axial compression tests were conducted to study the mechanical properties and energy
13 absorption of the pyramidal lattice truss structures. These two types of printed lattice
14 truss materials had close strength and rigidity. However, the vertically printed lattice
15 truss structures had excellent ductility and their struts never broken off during
16 compression. Three post failure styles of the vertically printed lattice truss structures
17 were observed, including strain-hardening, stable deforming and softening and
18 depending on the slenderness ratio of the strut. Theoretic analysis and finite element
19 method (FEM) were performed to investigate the compression behaviors of the
20 vertically printed lattice truss materials. Appropriate printing method and relative
21 density could make the 3D printed pyramidal structures achieve excellent specific

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