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An investigation into the quasi-static response of 316L gyroid structures manufactured using selective laser melting

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Porous structures manufactured using selective laser melting (SLM) have been widely used in fields such as tissue engineering, aerospace, and automobile. SLM-built gyroid structures made in stainless steel 316L has superior properties such as good corrosion-resistance, good biocompatibility, good self-supporting performance, and excellent mechanical properties. In this study, gyroid structures with different sizes were modelled and manufactured using SLM. Then the mechanical properties of the structures under quasi-static compression loads were investigated. The elastic moduli and yield stresses of the structures were calculated from stress-strain diagrams which was obtained by conducting quasi-static compression tests. Moreover, to estimate the discrepancies between the designed and the as-produced gyroid structures, an optical microscope was used to observe their micromorphology. Results shows that sizes of the as-produced structures were larger than their CAD (Computer-aided design) sizes, and the elastic moduli and yield stresses of the structures were improved as their thickness values increased. The process of compression failure shows that 316L gyroid structures manufactured using SLM has good toughness.

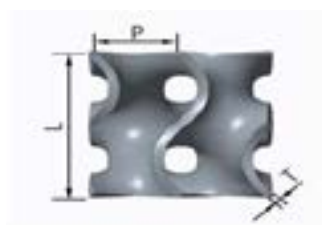


Figure 1: Unit of gyroid structure.



Figure 2: 316L gyroid structure samples manufactured using SLM.

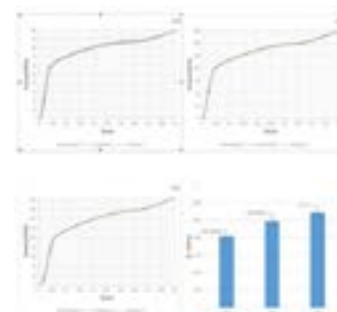


Figure 3: Nominal stress-strain curves and elastic modulus of gyroid structures.

Biography

Qian Tang has completed her PhD from Chongqing University, China. She is a Professor and Assistant Dean of College of Mechanical Engineering at the same university. Her research area focuses on the mechanical properties and the design methods of metallic components fabricated using Selective Laser Melting. Her other research interests are porous structure, tissue engineering and Finite Element Analysis.

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