Statistical and optimize of lattice structures with selective laser melting (SLM) of Ti6AL4V material

K. Kadirgama[a]; W. S. W. Harun[a]; F. Tarlochan[b]; M. Samykano[a]; D. Ramasamy[a]; Mohd Zaidi Azir[a]; H. Mehboob[b]

[a] Faculty of Mechanical EngineeringUniversiti Malaysia PahangGambangMalaysia

[b] Department of Mechanical and Industrial EngineeringQatar UniversityDohaQatar

ABSTRACT

This paper investigates the properties of titanium alloy (Ti6Al4V) lattice structures fabricated via selective laser melting (SLM). Response surface method (RSM) was used to design the experiments. Four factors were selected to determine its influence on the Young's modulus and compressive strength. Detailed characterizations such as dimensional accuracy, surface roughness, microstructure analysis, and compression test were conducted and reported. The built structures have a Young's modulus ranging between 0.01 and 1.84 GPa. The statistical method was used to find the relationship between factors and Young's modulus and compressive strength. Porosity was comprehended to play a significant role in determining the Young's modulus and compressive strength. The error of the developed model was in the range of 0.5 to 1.3% compared with experimental results. Meanwhile, all the four factors found not to affect the surface roughness significantly. The statistical method recognizes the trends of the factor effect on the Young's modulus, yield stress, and surface roughness.

KEYWORDS:

Addictive manufacturing; SLM; Lattice structure; Ti6AL4V; Young's modulus