Microstructural comparison and mechanical properties of stainless steel 316L fabricated by selective laser melting and metal injection moulding processes

Mohd Faizul Farhan Ahmad Hamidi[1]; Wan Sharuzi Wan Harun[2]; Nur Zalikha Khalil[2]; Mahendran Samykano[2]

[1]Institute of Postgraduate Studies, Universiti Malaysia Pahang, Pekan, Pahang, Malaysia
[2]Faculty of Mechanical Engineering, Universiti Malaysia Pahang, Pekan, Pahang, Malaysia

ABSTRACT

Selective laser melting (SLM) process is one of an additive manufacturing technology that has the capabilities of fabricating complex geometries with an excellent accuracy and resolution. Compared to conventional powder metallurgy techniques metal injection moulding (MIM), SLM has several advantages such as low production cost for small batch fabrication, high degrees of geometrical freedom and customisation, and short cycle time. The present work analyses and compares the tensile properties and metallography differences of the stainless steel 316L compacts fabricated by two powder-based manufacturing processes; SLM and MIM, respectively. The SLM compact was built at 0-degree building orientation by SLM 125 HL machine with default optimum processing parameters for stainless steel 316L powder. On the other hand, MIM process produced similar dimension of tensile-shaped compacts differently that by sintered at three different sintering conditions in highly pure argon flow atmosphere. The tensile testing revealed that SLM tensile compact was higher in tensile strength (29% more) and elongation (62% more) at fracture as compared to MIM compact. From microstructure observation, the MIM compact showed the presence of significant amount of porosity which led to moderate mechanical properties compared to SLM compact performances.

KEYWORDS

Selective laser melting; SLM; metal injection moulding; MIM; mechanical properties; microstructure

DOI: 10.1504/IJMTM.2019.100160