Microstructural and Mechanical Characterization of AlSi10Mg Additively Manufactured Material Using Direct Metal Laser Sintering Technique

S. P. Tan, M. A. Ramlan, M. S. Shaari, Akiyuki Takahashi, and M. R. M. Akramin

Abstract AlSi10Mg alloy produced by additive manufacturing (AM) technology using direct metal laser sintering (DMLS) technique has resulted better in handling complex geometry. However, limited studies are performed for this AM method to show the integrity of aluminium alloys produced by DMLS to meet the required industry standard. This study investigates the effect of post-process on microstructure, mechanical properties, and fatigue life behaviour to AlSi10Mg material that DMLS produces. In this study, the specimens were tested with different post-process types: annealing (TS) and heat treatment processes (T5 and T6 conditions). All test results were compared with as-built processed specimens. Scanning electron microscope (SEM) and optical microscope are used to capture the microstructure images. The results showed that the tensile strength of the post-processed was decreased approximately 25% (decreased from 391 to 299 MPa). Still, the ductility was approximately 200% (in-creased from 3.2 to 6.8%) higher than the as-built specimen. This is because spherical silicon particles become coarsened when the specimen ductility is increased after heat treatment. For fatigue behaviour, it shows the as-built and heat-treated specimens are closely similar compared to findings from the literature. Overall, this study showed that the post-process changed the tensile strength and microstructural of AlSi10Mg but only significantly improved fatigue performance.

Keywords AlSi10Mg · Additive manufacturing · DMLS · Fatigue life · Mechanical characterization

S. P. Tan · M. A. Ramlan · M. S. Shaari (✉) · M. R. M. Akramin
Faculty of Mechanical and Automotive Engineering Technology, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia
e-mail: shamil@ump.edu.my

A. Takahashi
Department of Mechanical Engineering, Faculty of Science & Technology, Tokyo University of Science, 2641 Yamazaki, Noda-shi, Chiba-ken 278-8510, Japan

M. Y. Ismail et al. (eds.), *Technological Advancement in Mechanical and Automotive Engineering*, Lecture Notes in Mechanical Engineering,
https://doi.org/10.1007/978-981-19-1457-7_28