UNIVERSITI TEKNOLOGI MARA

DUCTILITY IMPROVEMENT OF ADDITIVELY MANUFACTURED TI6AL4V ALLOY THROUGH HEAT TREATMENT

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ABSTRACT

Selective laser melting (SLM) is one of additive manufacturing (AM) technique that enable the production of high strength Titanium Ti6Al4V alloys that are currently demanded by bioengineering applications. However, Titanium Ti6Al4V alloys exhibited the lowest ductility as compared to other bioengineering material which is due to the rapid cooling of SLM process that produced acicular α′ martensite. Thus, in this study, the effect of different heat treatment temperatures of SLM fabricated Ti6Al4V alloy sample on its microconstituents and mechanical properties were investigated with the objective to increase the ductility of Ti6Al4V alloys. The selected heating temperatures were 800 °C, 850 °C, 950 °C and 1050 °C before samples were furnace cooled. The morphological behaviour of the samples before and after heat treatment were observed using optical microscopes, SEM, and XRD. Both tensile strength and Vickers microhardness were also measured. The results indicated that heat treatment successfully reduced the production of α′ martensite and induced formation of α and β lath which led to increment of ductility of the samples. Both tensile strength and hardness values reduced after heat treatment but the values are still appreciable for bioengineering applications. In conclusion, heat treated samples showed increment of ductility values of more than 60% thus achieving the objectives of the studies.

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