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Hybrid additive manufacturing of Al-Ti6Al4V functionally graded materials with selective laser melting and cold spraying

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Abstract: A hybrid additive manufacturing technology for fabricating functionally graded materials (FGMs) is proposed in this paper. The new process represents a combination of two existing additive manufacturing processes, selective laser melting (SLM) and cold spraying (CS). The targeted experiment of Al and Al+Al_2O_3 deposited onto SLM Ti6Al4V via CS reveals that the hybrid additive manufacturing process can produce thick, dense and machinable FGMs composed of non-weldable metals without intermetallic phase formation at the multi-materials interface. The SLM Ti6Al4V part exhibited fully acicular martensitic microstructure in contrast with α+β microstructure in the Ti6Al4V feedstock, while the grain structure of the CS Al part had no significant change as compared with the Al feedstock. Due to the phase transformation of the SLM part and work hardening of the CS part, the overall hardness of the FMGs was higher than that of the feedstock.

Keywords: selective laser melting (SLM), cold spraying (CS), functionally graded material (FGM), additive manufacturing (AM), XRD, grain microstructure

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