The Minerals, Metals & Materials Series

Achieving heterogeneous network microstructure in laser additively manufactured hybrid TiBw/TiC/Ti6Al4V

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Laser-directed energy deposition and in-situ alloying processes were used to manufacture hybrid in-situ TiBw/TiC/Ti6Al4V composites while varying the powder flow rate of both TiB2 and TiC. The optical microscopy (OM) and scanning electron microscopy (SEM) reveal that both in-situ TiB-whiskers and TiC particles precipitated at prior β boundaries. This led to the formation of a heterogeneous network and novel network microstructures. It was found that the heterogeneous network microstructure consisted of fine-grain zones with a network structure and coarse-grain zones with spherical structures. The effect of adding TiB2 and TiC on microstructure features and hardness was systemically investigated. It was found that the was no significant increase in the microhardness as the powder flow rate increased of both reinforcements.