High-temperature solution nitriding and low-temperature surface nitriding of 3D printed stainless steel

The present work focuses on gaseous thermochemical treatment of stainless steel parts produced by Selective Laser Melting (SLM). Specifically, high temperature solution nitriding (HTSN) and low temperature surface nitriding (LTSN) of SLM 316L stainless steel samples are investigated.

The cellular structure and the fusion-boundaries present in the as-printed SLM 316L stainless steel are removed by austenitisation and HTSN treatment. The treatments result in a homogenization of the printed microstructure and a lower bulk hardness compared to the as printed state. Due to the continued presence of elongated austenite grains, the removal of the cellular structure is attributed to recovery and/or elemental homogenisation. LTSN was performed successfully on SLM samples after both austenitisation and HTSN, resulting in a hardened layer consisting of expanded austenite. Pre-treatment with HTSN leads to a thicker case and higher hardness as compared to austenitisation as a pre-treatment.

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