Surface signatures of additively manufactured 316L stainless steel

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Abstract:

One of the challenges in laser powder bed fusion (LPBF) process is to make dense defect-free component. The fraction of porosity defects critically depends upon the melt pool geometry and interlayer bonding. Thus, a careful examination of the melt pool tracks can provide insights into different processing regimes. In this study, a novel high-throughput (HT) surface methodology is applied to hundreds of hex nut-specimens each processed at different combinations of laser power, scanning speed, and hatch spacing. The variation in the surface roughness provided direct correlation with the internal porosity defects (i.e., lack-of-fusion, balling, and keyhole). A comparison of the processing bounds with the analytical models was made to identify the optimal processing regime and generate PV processing maps for 316L stainless steel. Applications to other alloy systems will be discussed.