Development of contour scanning parameters to improve surface finishing of additive manufactured parts

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Additive manufacturing (AM), widely known as 3D printing, is a method of manufacturing that forms parts from powder, wire or sheets in a process that proceeds layer by layer. Many techniques have been developed to accomplish this via melting or solid-state joining. The surface topology of AM produced parts is typically worse than that of other manufacturing technologies, such as machining and casting, due to the layer-wise manufacturing process. The objective of this work was to develop a process parameter set for application to the contours which define the edge of every consolidated part and ultimately also the properties of the external and internal surfaces of any part that is produced by the SLM (Selective Laser Melting) method. Contours follow the edges of the part, melting along free surfaces of the part geometry. Contour scans are done in SLM to improve the surface finish of components. Experiments were set up on the custom built selective laser melting platform within the LENS enclosure. The laser used was an IPG YLS 5000 ytterbium 5kW fibre laser. Wavelength 1076 nm. Delivery fibre core diameter of 50 µm. The scanner used was an Intelliweld 30 FC V system. Materials used were Ti6Al4V, gas atomized with particle size 20-60µm. Surface roughness measurements were done using a commercially available calibrated Talysurf mechanical probe and micro X ray tomography. There is a marked improvement in surface finish compared to the standard sample without contour scanning. The contour-hatch overlap showed a significant effect on surface finish however there is a trade-off between surface finish and porosity.