EXPERIMENTAL TECHNIQUE FOR POROSITY CHARACTERIZATION FOR 3D-PRINTED INCONEL SUPERALLOY

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ABSTRACT

This collaborative research studies the defects of Inconel, fabricated by 3D printed method. Selective laser melting (SLM) was used to print Inconel powder into rectangular test specimens at different laser power and scanning strategies. Both surface and volumetric defects are seen when examining the sample microstructure.

The procedure to characterize porosity included obtaining microstructural images, and statistically analyzing the pore distribution. To obtain the microstructural image, a sample was sectioned by electrical discharged machining (EDM), mounted in a plastic mold, hand grinded, polished using diamond-based polishing compounds, and chemical-etched to reveal the microstructure and internal defects, such as pores. To characterize pore distribution, high resolution images of a sample were taken with a microscope, converted to binary images, and scanned using the ImageJ software, which grouped each pore in multiples of pixels.

Statistical analysis yielded that the average pore size was around 10μm, with the largest pore measurement being 156μm. A decreasing trend of pore distribution with increasing building height was noticed; as the height distance increases from 10 to 80mm, the maximum pore size decreases from 140μm to 75μm, due to different cooling rates during solidification.