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Characterization of texture in selective laser melted Inconel 718 samples using monochromatic neutron radiography

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Additive Manufacturing (AM) offers the opportunity to produce easier geometrically complex parts compared to traditional production technologies. An important AM technology for metals is selective laser melting (SLM) where a part is produced by melting and solidifying powder in layers. This technique is known to cause a pronounced texture in the produced AM products due to the specific heat flow and the associated solidification of the material during SLM deposition. In order to evaluate the influence of the deposition hatch length during SLM of nickel based superalloy Inconel 718 samples on the texture and in order to identify any preferred crystallographic direction, we performed monochromatic neutron radiography scans (using wavelength from 1.6 Å to 4.4 Å, step size 0.05 Å) to image the samples while rotating it through 90°. Samples produced with short hatch length showed fine textured columnar grains oriented along the sample building direction in high-resolution radiographs. Whereas processing the sample using a ten-fold longer hatch length reduced the texture. The neutron radiographic experiments were accompanied by scanning electron microscopy including electron back-scattered diffraction to visualize and verify the microstructure and texture.

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