Performance of additively manufactured Nickel Superalloys and Ti6Al4V on Renishaw's multi-laser AM systems

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In this study, the density and mechanical properties of Inconel 718, Inconel 625, and Ti6Al4V parts fabricated using a quad-laser Renishaw machine (500Q) were measured. All three materials produced high and consistent ductility across the build plate in the as-built and heat-treated state irrespective of layer thickness (30 µm or 60 µm). This has been attributed to the efficient gas flow on 500Q.

In 500Q, each of the four lasers can address the whole build plate so different build times are achieved depending on how many of the lasers are employed. For example, a single laser 60 µm layer Inconel 718 tensile test array took around 28 hours to build whereas the same array in the same layer thickness using four lasers (with one laser per part) took only 11 hours. Irrespective of these build time differences, the test samples from both arrays exhibited similar mechanical properties after heat treatment. The similarity in mechanical properties can be explained by the similarity in grain size and texture, analysed by electron back scattered diffraction (EBSD). In contrast, EBSD analysis of samples from the same tensile array built using 30 µm layers (four lasers, one laser per part) revealed larger grains and stronger texture than 60 µm samples, despite exhibiting similar mechanical properties. These observations and suggested causes will be discussed.