Influence of Printing and Post-Processing Parameters on Microstructure and Texture in Laser Powder Bed Fusion Manufactured Haynes 282

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Abstract

Haynes 282 (H282) is a nickel-based superalloy which has high performance in structural applications but is also printable by laser powder bed fusion (LPBF). The use of LPBF to manufacture H282 parts is desirable because it allows for complex geometries that would otherwise be very difficult to produce. Parts manufactured using LPBF can have very different microstructures and texture depending on the specific printing parameters used. Additionally, since H282 is a precipitation strengthened alloy, it generally requires heat treatment after printing to develop desirable precipitate structures. The specific post-processing heat treatments used will also influence the final microstructure and texture. Thus, the microstructure and texture of LPBF H282 parts will be the result of both the printing and post-processing parameters used. A greater understanding of how these parameters affect the microstructure and texture in H282 is therefore very important to better choose them when making parts. This will allow for better control of the final microstructure and texture of printed H282 parts, which will ultimately influence their mechanical performance. In this work, samples of Haynes 282 were fabricated via LPBF with different printing parameters, including parameters with varied scan strategy and varied laser scan speed. The microstructure and texture of these samples were studied using a variety of techniques including electron backscatter diffraction (EBSD) and X-ray diffraction (XRD). Observed variations in the as-printed microstructure and texture were correlated with the printing parameters. Post-processing heat treatments were also carried out on some of the samples to study how the as-printed microstructure and texture evolved with heat treatment. Hardness testing was used to quantify anisotropy in the mechanical properties resulting from the different printing and post-processing conditions investigated. This was followed up by further mechanical testing including tensile and creep testing to evaluate the mechanical performance resulting from different manufacturing conditions.

Keywords: Additive Manufacturing, Laser Powder Bed Fusion, Superalloy

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