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Rapid Process Qualification for W-DED Ti-6Al-4V

Jonathan Pegues[1], Brian Hoover[2], Tim Ruggles[1], Luis Jauregui[1], Shaun Whetten[1], Andrew Kustas[1]

[1] *Material, Physical, and Chemical Sciences Center, Sandia National Laboratories, Albuquerque, NM 87185, USA*
[2] *Advanced Optical Technologies, Inc., 1451 Innovation Pkwy SE, Albuquerque, New Mexico 87123 USA*

Wire based directed energy deposition (W-DED) witness sampling is fundamentally more challenging than many additive manufacturing methods. There are several process-structure challenges associated with W-DED materials that can affect the microstructure and mechanical properties of these materials. Conventional approaches to process qualification are laborious and time consuming, requiring innovative approaches and technologies to rapidly iterate through the process space and achieve a desired mechanical response. High throughput tension testing and large area quantitative polarized-light microscopy are leveraged to accelerate the microstructural and mechanical characterization of W-DED Ti-6Al-4V. Large-area quantitative polarized light microscopy provides a much-needed solution to better characterize large columnar prior-beta columnar grains and identify processes that result in deleterious continuous alpha grains. Results are discussed in the context of process optimization, qualification, and verification through both witness sampling and destructive part analysis.

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