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Microstructure characterization of WC-9.2wt%Monel 400 fabricated using laser engineered net shaping.

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ABSTRACT:

To assess if a WC-9.2wt%Monel 400 alloy properties could be improved using LENS, one alloy was deposited onto a heated substrate and a second alloy was subjected to laser remelting of the final deposited layer. Microstructural characterization was performed using XRD, FESEM, EPMA, and Raman spectroscopy. Multiple microstructures were observed with eutectic, fishbone, and Fe/W-rich dendrites present in the fusion zone at the substrate-alloy interface, while needle-like, triangular and blocky carbides were found in the central regions, with acicular microstructures in the surface region. The alloy deposited onto the heated substrate had less eutectic and more fishbone structures in the fusion region. The laser remelted surface layer had a more homogenous acicular structure with minimal binder pooling compared to the other alloys. The spheroidal, cast WC/W_2C powder particles were found to have core-rim structures after laser sintering. These microstructural variations resulted in a gradient hardness profile from the substrate-alloy interface to the alloy surface. The surface hardness of the laser remelted alloy was found to be significantly higher compared to the other alloys.