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Hybrid Wire Laser Additive Manufacturing and CNC machining for advanced SRF cavity fabrication

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The fabrication of Superconducting Radio Frequency (SRF) cavities traditionally relies on forming and welding high-purity metal sheets, resulting in a local surface discontinuity that degrades the final SRF performance. In this work, we propose and explore a novel hybrid approach combining Wire Laser Additive Manufacturing (WLAM), with in situ CNC machining for the fabrication of mono-cell 1.3 GHz SRF cavity. This technique enables the layer-by-layer deposition of high-purity metals with precise dimensional control, while simultaneously integrating subtractive steps to maintain tolerances and surface quality crucial for RF performance. The hybrid WLAM and CNC machining stands as a candidate for next-generation SRF cavity production minimizing material waste, eliminating the need for electron beam welding, through the direct creation of complex geometries, and enhancing the surface finishing in the as-built condition. Results on stainless steel 1.3 GHz prototype are presented.

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Footnotes

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