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Benchmarking LPBF Dimensional Accuracy with ISO/ASTM 52902: A Comprehensive Build Plate Targeting Holes and Thin Walls

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The dimensional accuracy of components manufactured by Laser Powder Bed Fusion (LPBF) is a critical parameter that directly impacts product quality, reliability, and performance. Given the ongoing proliferation of LPBF machines and processes, there is an emerging need for standardized techniques that are efficient to evaluate the dimensional accuracy of parts produced by this technology. Reference artifacts with geometries specifically designed to analyze and test the capabilities of LPBF equipment provide a practical basis for cross-platform comparative research. Through systematic comparison with such artifacts, researchers, original equipment manufacturers (OEM) and end-users can study the capabilities and limitations of different technologies on a peer-to-peer basis in controlled environments. This enables more informed decisions on technology selection for specific applications and industries. This work provides an overview of the current state of knowledge regarding the factors that influence the dimensional accuracy of components produced by LPBF technology and the effective evaluation methodologies. It also highlights the key criteria for artifact design. The current literature survey delineates a range of artifact geometries, each of which embodies critical LPBF characteristics. These geometries are subject to dimensional deviations and, consequently, serve as tools for evaluating system performance. Based on the findings from this state-of-the-art analysis, margins for improvement are proposed utilizing ISO/ASTM 52902 as the overarching design framework. This approach was undertaken to develop a novel benchmark artifact. The proposed design is intended to address features such as holes and thin walls through the implementation of controlled arrays spanning the dimensions, orientations, and positions of the build plate. This approach is designed to enable targeted and repeatable feature-level accuracy assessment across different LPBF platforms.

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