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# ABSTRACT

## Study on Cold Metal Fusion as a Competitive Process for Series Production in Metal Additive Manufacturing: Material Properties and Production Efficiency

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Over the past two decades, Additive Manufacturing (AM) has become a key technology in production engineering, offering design flexibility, cost efficiency for low-volume production, and accelerated development cycles. Metal AM, particularly Laser Powder Bed Fusion (PBF-LB), enables the production of highly complex components with excellent material properties. However, its economic viability for medium- to high-volume production is limited due to inefficient build space utilization, the need for support structures, and extensive post-processing, which increases costs and restricts scalability. In contrast, Selective Laser Sintering (SLS) achieves higher packing densities without support structures, enabling more efficient batch production. Cold Metal Fusion (CMF) combines Laser Sintering with powder metallurgy processes, improving scalability and cost-efficiency, thus making AM a more competitive option for series production.

In this paper, the potential of CMF as a manufacturing process capable of competing with both additive and conventional subtractive methods is investigated. Density, porosity, hardness, as well as strength, stiffness, elongation, thermal conductivity, and thermal expansion in different build orientations are analyzed. These results are compared to those of PBF-LB parts to assess CMF's technical viability in various applications. Surface roughness and the impact of surface treatments on green and sintered parts are studied. The expected results will reveal the economic benefits of surface treatment in the green state compared to fully processed metal components, where post-processing is more complex. Geometric shrinkage and warpage are analyzed using optical methods. These findings aim to demonstrate CMF's competitiveness and technical feasibility for serial production.

Keywords: 3D Metal Printing, Sintering, Powder Metallurgy, Laser Powder Bed Fusion, Indirect Selective Laser Sintering