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# Optimization of electron beam melting parameters for intricate vs. bulky geometries

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**Abstract**

Electron beam melting powder bed fusion (PBD-EB) is an advanced additive manufacturing technology, particularly suitable for highly conductive and optically reflective pure copper parts. However, the relevance of process parameters with part geometry is not yet fully understood. This paper investigates suitable parameter sets for the manufacturing of copper parts, particularly for producing advanced electrical copper windings. The effects of various process parameters and scanning strategies on the density, surface roughness, and electrical conductivity of the fabricated parts are studied. It is demonstrated that the geometrical integrity of pure copper parts can be improved by optimizing the process parameters and scanning strategies for both intricate components and bulky parts. The size of thin-wall structures can be controlled by the electron beam focus offset. Bulky parts are influenced more by the combination of other processing parameters such as beam current and scanning speed in correlation to the part size and density. Since the geometrical accuracy of the overhang structures are determined by the thermal conductivity and the surrounding support structure during the process, this study has developed a local sintering strategy that could replace the regular supporting structures and hence minimize the post-processing needed to remove the support. To prove the applicability of this study, the findings are utilized to manufacture electrical windings successfully.

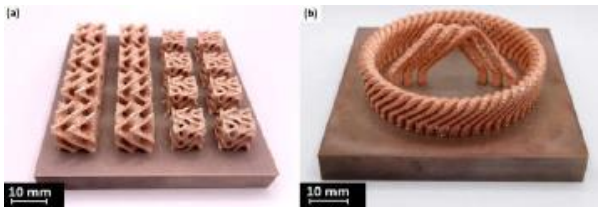


**Figure 1**: Some copper parts made by PBF-EB after optimizations