Fast and reliable method for supports release in metal AM by sandblasting-driven process

FAST AND RELIABLE METHOD FOR SUPPORTS RELEASE IN METAL AM BY SANDBLASTING-DRIVEN PROCESS

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The LB-PBF (laser beam powder bed fusion) process for metal alloys is largely used in industrial and academic fields for the AM (additive manufacturing) of components. However, the process is still affected by cost and time issues, which include powder and inert gas management, micromelting process, thermal post-processing, supports release and mechanical finishing. Then, the optimization of each process phase is crucial for the technology scalability. This paper focuses on the supports release and introduces the design of supports for the fast removal through sandblasting process instead of traditional manual release or release based on mechanical tooling.
The supports release by sandblasting is achieved on the AlSi10Mg alloy through: (a) the study of geometrical parameters of the supporting structures to enable more effective abrasive media flow through the supports, and (b) the study of the process parameters to modulate the structural strength of supports through controlled porosity. The best supports geometry and combination of laser power and speed is defined.
The mechanical properties of the supports material have been characterized by considering the growth direction and the geometry (Fig. 1). The combinations of supports and laser parameters are processed with a DOE (design of experiments) on a target object. The target object (Fig. 2a) is a cube with many significant features concentrated in it (holes, suspended parts, embossed details, etc.). The local deformations on samples are measured to control the process output. The sandblasting process is finally validated on the supports of a complex component represented by the cylinder of a 250cc two-stroke engine (Fig. 2b).
The sandblastability of each sample is quantified by four quality levels (Fig. 3). The sandblasting process is reported in Fig. 4 and one job of samples fabrication in Fig. 5. Finally, the proposed process demonstrate the possibility to design the supports for fast and complete release through sandblasting with high efficiency compared to traditional release methods especially for small features and holes with reduced accessibility.

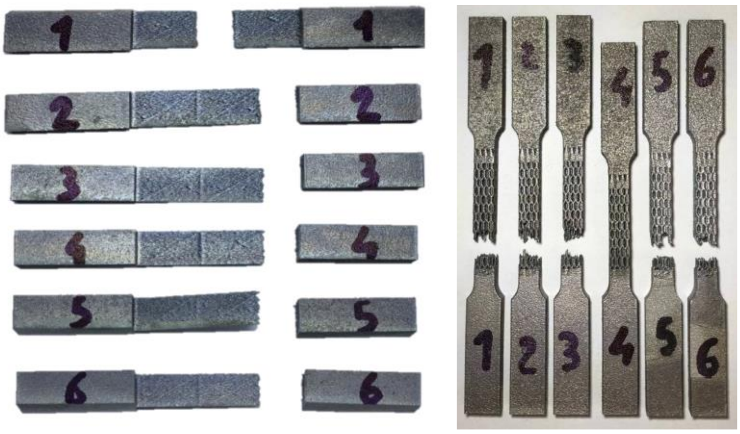
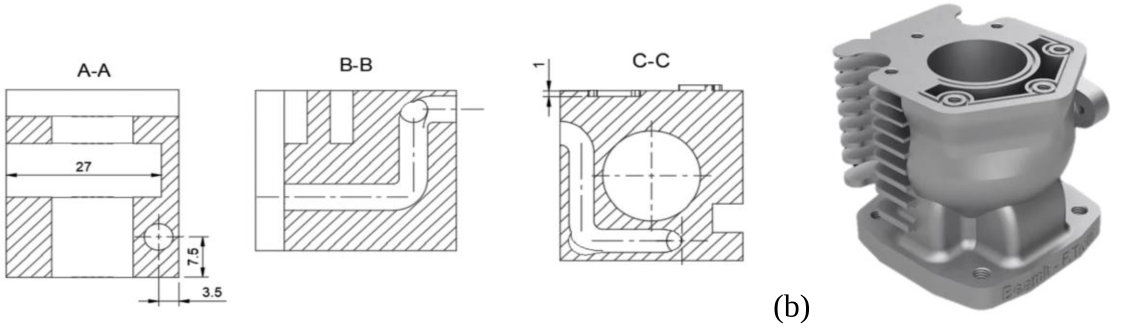


Fig. 1. Samples for tensile characterization of bulk and lattice supports.



(a) (b)

Fig. 2. Target cube objet with significant features (a) and engine cylinder component (b) used for the optimization and validation of the sandblasting-driven supports release.

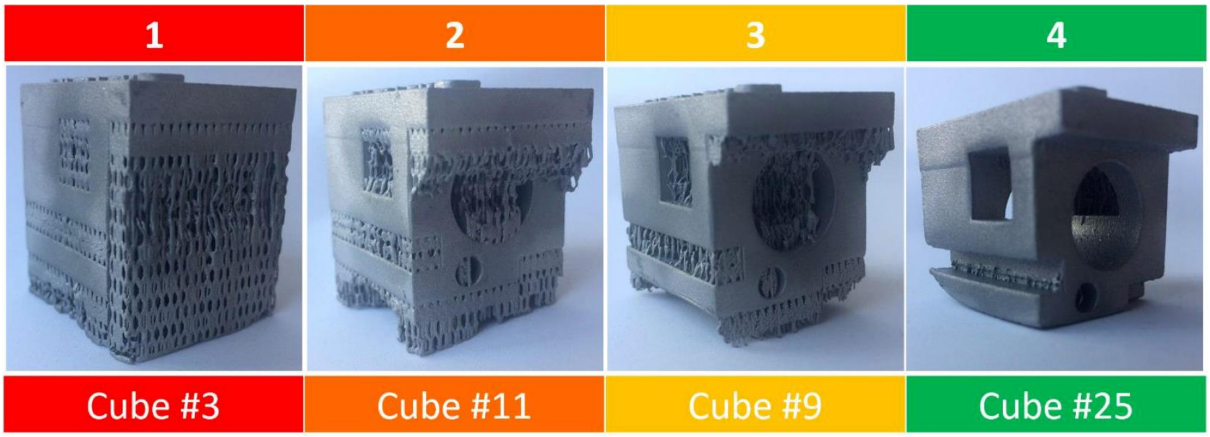


Fig. 3. Qualitative scale for the efficiency categorization of the sandblasting process for supports release.

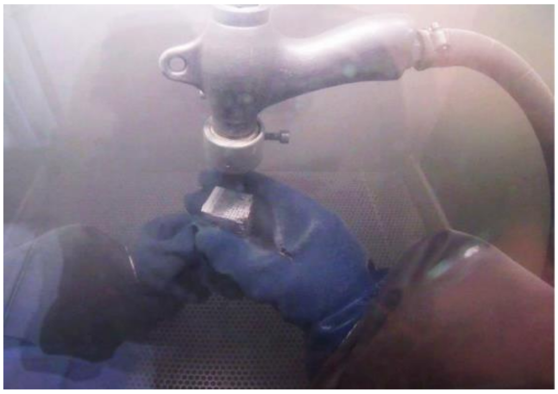


Fig. 4. Sandblasting process.

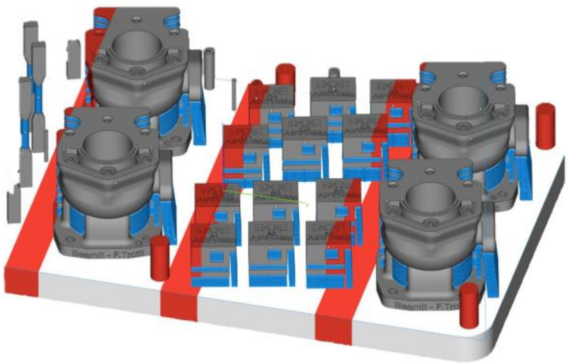


Fig. 5. LB-PBF job setup for the building of samples with optimized supports.

References

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