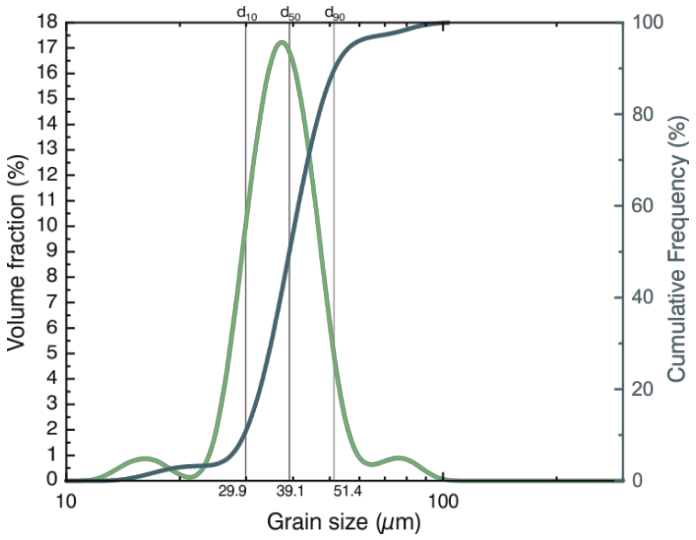
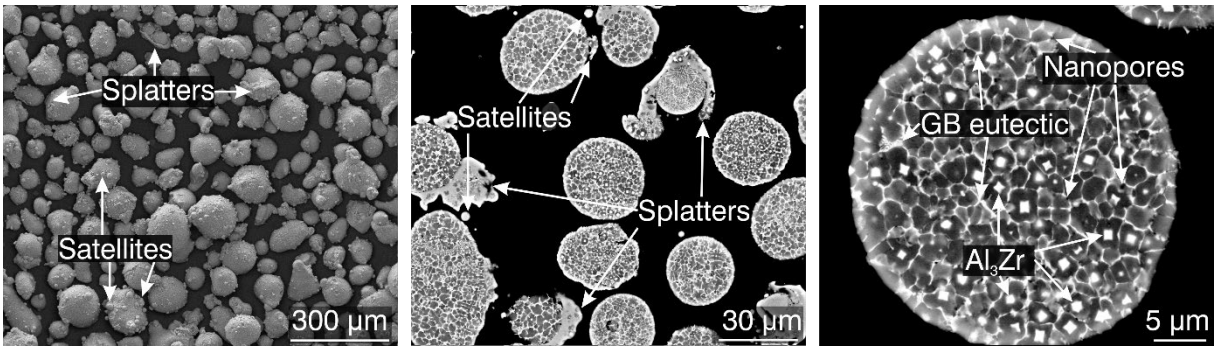
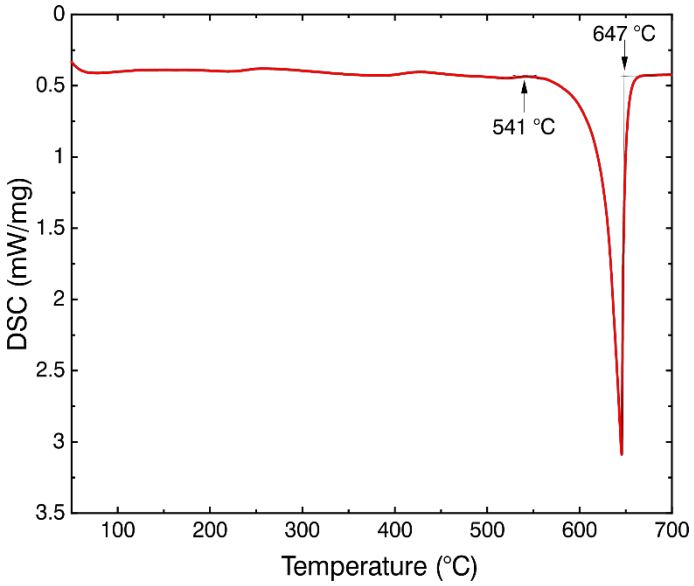
Supplementary material



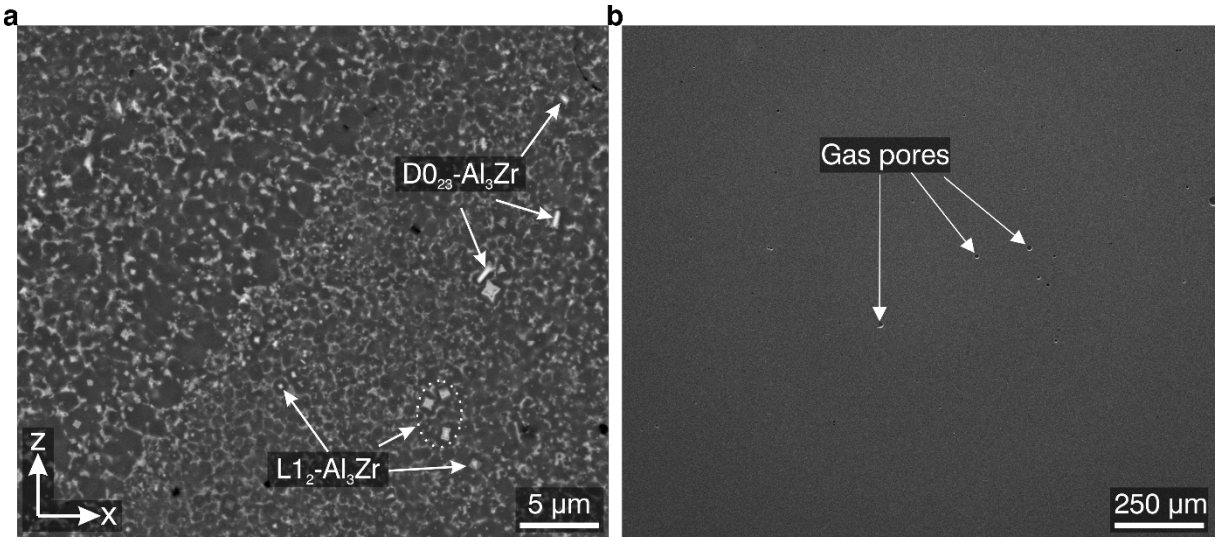
Supplementary Figure 1 – Powder size distribution. *Evaluated by laser diffraction measurements. The powder shows a right-skewed, Gaussian-shaped size distribution with a noticeable fraction of fine, sub 20 µm, and coarse, super 70 µm grains. A d_{50} of 39.1 µm, with a d_{10} of 29.9 µm and a d_{90} of 51.4 µm is estimated.*



Supplementary Figure 2 – Powder analysis. *SEM-EDS/BSD image of the powder's surface and cross-section. The powder shows decent sphericity with many satellite particles and a high number of splatters located around the particles. Numerous primary Al_3Zr precipitates can be seen within grains. The GBs are covered by a continuous eutectic layer formed by segregation. Nanopores are rarely detected on the GBs.*



Supplementary Figure 3 – DSC analysis. *The alloy has an experimentally determined solidification interval of 106 °C. The exact determination of both solidus and liquidus temperature is difficult due to the indistinct transition points.*



Supplementary Figure 4 – Two Al_3Zr phases visible in an SEM-BSD image and low magnification SEM-ETD image*. a) In addition to numerous metastable $L1_2$-Al_3Zr precipitates, stable $D0_{23}$-Al_3Zr was detected sporadically and inhomogeneously distributed in the cross-sections. The latter does not contribute to grain refinement due to its incoherence to the matrix. b) SEM-ETD image of lower magnification shows sporadic circular gas pores.*