

Mechanical behaviors at 77K of Zr-modified Al 7075 alloy printed by L-PBF

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Decreasing the mass of structure is the main goal of aerospace industries. One solution to do so is to remove all unnecessary parts when designing them. Classical fabrication methods do not allow such new designs to be easily implemented. Recent development of additive manufacturing technologies allows huge mass reduction in those industries. Optimization of printing strategies for different alloys has been of great importance in recent research (1,2).

Recent works focuses on the development of printing strategies for Al 7075 series (3,4), a high-strength aluminum alloy. As printing strategies are now better understood, it becomes important to determine their mechanical properties at their working temperature. Using a home-made tensile device working at cryogenic temperatures, the mechanical characterization of Zr-modified Al7075 alloys has been carried out. The results are promising when compared to classical Al7075-T6 . The AB samples have a yield stress of 415 MPa at RT and 476 MPa at 77K with correct elongation values (>14% at both temperatures) while T6 samples presents values of 550MPa and 650MPa at those temperature respectively. However, through optimized thermal treatment, we achieve the stress level of 526MPa and 668MPa at both RT and cryogenic temperatures for the printed samples. X-ray tomography analysis and Scanning Electron Microscopy characterization have been carried out to understand the deformation mechanisms taking place at cryogenic temperature compared to room temperature.

References

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