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Characterisation of additively manufactured niobium alloys.

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The laser-powder bed fusion fabrication route has recently garnered attention for its potential to manufacture high-temperature resilient components. In this work, we study the complex microscopic world of additively manufactured refractory Nb alloys, emphasizing the exploration of their intrinsic microstructural attributes. Moreover, the evolution of intragranular and grain-boundary precipitation as a function of aging temperature was followed. The X-ray diffraction analysis illustrates the variations in orientations in both the processor powders and the fabricated components. As-build componets presents columnar grain structures. In addition, a very low residual microporosity (below 2%) with refined homogeneous microstructure was observed. Microindentation hardness values ranged from 0.92 to 1.2 GPa for the L-PBF, solid components. It was found, that precipitates along the grain boundaries and the non-equilibrium phases have a fundamental influence on the mechanical properties in high-temperature environments. Due to an extremely low level of internal defects as well as microstructure homogeneity, as results of L-PBF process, the material properties of the manufactured alloys appear very consistent with a small scatter.