

Manufacturing alloys in the synchrotron

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Laser powder bed fusion (L-PBF) has become an increasingly popular technology because it allows near-net shaped fabrication of metallic components. The microstructures obtained are highly dependent on the laser parameters used, offering the possibility to tune microstructure and mechanical behavior locally. The high temperatures, rapid cooling rates and multiple thermal cycles during L-PBF make it however difficult to understand and control the formation of particular microstructures.

Thanks to the high brilliance and the fast detectors available at synchrotrons, insitu/operando diffraction and imaging experiments have become possible during laser powder bed fusion (L-PBF). These type of experiments allow to track phase transformations during fast heating and solidification with a time resolution of 50 μ s, providing the cooling rates of each phase and the link with deposition parameters such as the scanning vector length. The usefulness of such experiments to validate finite element based computational models will be illustrated.

Keywords: Microstructure, L-PBF, operando, synchrotron

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