

CREEP DEFORMATION OF TI ALLOYS PRODUCED BY LPBF

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The laser powder bed fusion (LPBF) was applied for near α (hcp) -Ti alloy (Ti-6Al-4Nb-4Zr, wt%) and near β (bcc) - Ti alloy (Ti-6Al-2Sn-4Zr-6Mo) to investigate microstructure evolution depending on scanning conditions and creep deformation behavior related to microstructure.

The melting pool boundaries that are formed by cyclic heating due to cyclic scanning of the laser beam were clearly observed in the as-built state in both alloys. The crystallographic orientation of the β phase was random in near α -Ti alloys, while columnar microstructures with crystallographic lamellar-like microstructure (CLM), a near single crystal-like microstructure (SCM), and polycrystalline structures (PCM) were observed under the specific scanning condition in near β -Ti alloys.

The creep deformation mechanism is dislocation creep, which depends on the microstructure in the molten pool rather than the grain size in both alloys. Even so, grain size dependence of creep life was observed in near α -Ti alloy. In near β -Ti alloy, there is no significant difference in creep deformation between SCM, CLM, and PCM. The creep strain was larger at low stress in the LPBFed samples compared with the forged sample, but the creep life was slightly longer in the LPBFed samples than in the forged sample.