

Friction stir processing on Ti6Al4V produced by Selective Laser Melting: microstructure and mechanical properties

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The low ductility of Ti6Al4V alloy manufactured by Selective Laser Melting (SLM) adversely impacts the component performance in practical applications. A local post-treatment by Friction Stir Processing (FSP) significantly reduces the porosity and homogenizes the microstructure. This results in an increase in fracture strain from 0.21 after SLM to 0.65 following the FSP post-treatment. The porosity reduction was evidenced by 3D X-ray micro-computed tomography. A fully transformed β microstructure is formed after FSP. This microstructure involves α plates, α colonies, as well as equiaxed dynamically recrystallized α phases inside equiaxed prior- β grains. The deformed microstructure was observed during in-situ tensile test, using scanning electron microscopy, with the aim to unravel the damage mechanisms. In addition to the beneficial effect of initial porosity reduction, the transformed microstructure after FSP bears more damage before failure than the typical α' martensite laths in the as-built SLM samples.