Analysis of surface and bulk effect during martensite-to-austenite reversion of an additively manufactured 18Ni maraging-steel

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Maraging steel are widely used due to its good strength and fracture toughness combination. Enhancement of ductility can be achieved by TRIP mechanism of reverted austenite through alloying design. The 18Ni maraging steel presented a high number of alloying elements providing accelerated austenite reversion kinetics and increased austenite volume fraction and facilitated austenite reversion during annealing or tempering. However, the transformation mechanism on a sample can be challenging to predict when comparing bulk and surface material. Different features as stress-state, residual stress, free surface, and chemical potential are found. An in-situ XRD analysis on the material surface was compared to an in-situ XRD of the bulk material to assess the phase transformation difference. It shows that bulk material presents a higher capacity of reversion compared to the surface. Simultaneously, the kinetics in the early stages of transformation occurs before the surface, later in the bulk material. Austenite transformation at the surface presents a higher instability, and XRD features show slight martensite transformation. Material constraint in the bulk material difficulties the austenite back transformation to martensite.