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A Microstructure Model for Laser Processing of Ti-6Al-4V

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Abstract

The current challenge in laser processing titanium alloys using methods such as Laser Metal Deposition (LMD) is in understanding the complex microstructure evolution during multiple passes of the laser. The microstructure is affected by the repeated thermal cycling that occurs during the deposition process. The current work focuses on the thermal and microstructural modeling of multilayered Ti-6Al-4V deposits. Prior work with LMD-Ti-6Al-4V has shown that a complex microstructure evolves consisting of a two-phase alpha+beta structure that is measurably different across the deposit. A microstructure model has been developed to predict the evolution of the alpha fraction during thermal cycling. Alpha dissolution and growth rates were obtained using computational thermodynamics and diffusional phase transformation software as well as available TTT diagrams. The results indicate that during the *n+3* layer addition, the material in layer *n* will experience the greatest change in evolution path. The results of the microstructure model will be discussed in relation to the as-deposited microstructure.

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