

Symposium: Cost Affordable Titanium

## **A Coupled Thermal and Microstructure Model for Laser Metal Deposition of Ti-6Al-4V**

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### **Abstract**

Near-net shape processes, such as laser metal deposition (LMD), offer a unique combination of process flexibility, time savings, and reduced cost in producing titanium alloy components. The current challenge in processing titanium alloys using LMD methods is understanding the complex microstructure evolution as a part is fabricated layer by layer. The microstructure is effected 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. Depending on the location within the part, the Widmanstatten alpha morphology may be colony (layer band) or basketweave. A thermal model has been developed using finite difference techniques to predict the thermal history of LMD processes. The characteristics of a thermal cycle are used to semi-quantitatively map the evolution of equilibrium and nonequilibrium phases in the deposit. The results of the thermal and microstructure models will be discussed in relation to the as-deposited microstructure.

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