

**PROCEEDINGS**

## Micro-and Meso-Structures of Ti-6Al-4V Formed by SLM Process and Its Formation Mechanism

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### ABSTRACT

In order to regulate the multi-scale structure of Ti-6Al-4V formed by the SLM (selective laser melting) process, this study uses the method of combining numerical simulations with experiments to investigate the effects of SLM process parameters on the phase composition, micro- and meso-structures, and their distribution of Ti-6Al-4V. The study shows that the SLM-formed Ti-6Al-4V is mainly composed of  $\alpha/\alpha'$  phases. Horizontally, the specimens at a  $0^\circ$  phase angle mainly show a striped pattern, while the specimens at  $67^\circ$  and  $90^\circ$  phase angles will show a tessellated pattern. Vertically, the specimens at  $0^\circ$ ,  $67^\circ$ , and  $90^\circ$  phase angles exhibit columnar crystal structures, and these micro- and meso-structural differences are mainly caused by the size, orientation, and distribution of martensite. Furthermore, with the increase in energy density, the percentage of tessellated pattern area decreases while the martensite size increases. The complex thermal history under different process parameters is the main reason for the formation of different micro- and meso-structures. The results of this study provide a basis for SLM to regulate the process parameters.

### KEYWORDS

Selective laser melting; titanium alloy; microstructure and mesostructure; formation mechanism

**Acknowledgement:** The authors would like to acknowledge the National Natural Science Foundation of China (Nos. 52175359), the China Postdoctoral Science Foundation (No. 2023M743281) for their financial support, and the Wuhan University of Science and Technology Analysis and Testing Center for their technical support on electron microscopy.

**Funding Statement:** The work was financially supported by a grant from the National Natural Science Foundation of China (Nos. 52175359), China Postdoctoral Science Foundation (No. 2023M743281).

**Conflicts of Interest:** The authors declare that they have no conflicts of interest to report regarding the present study.



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