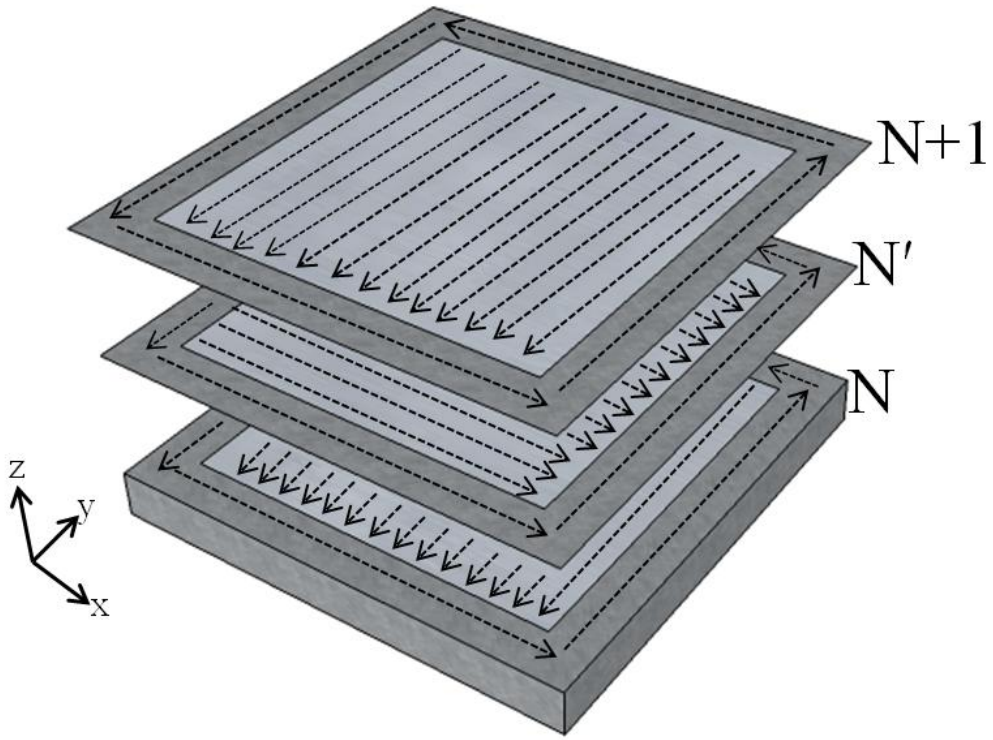
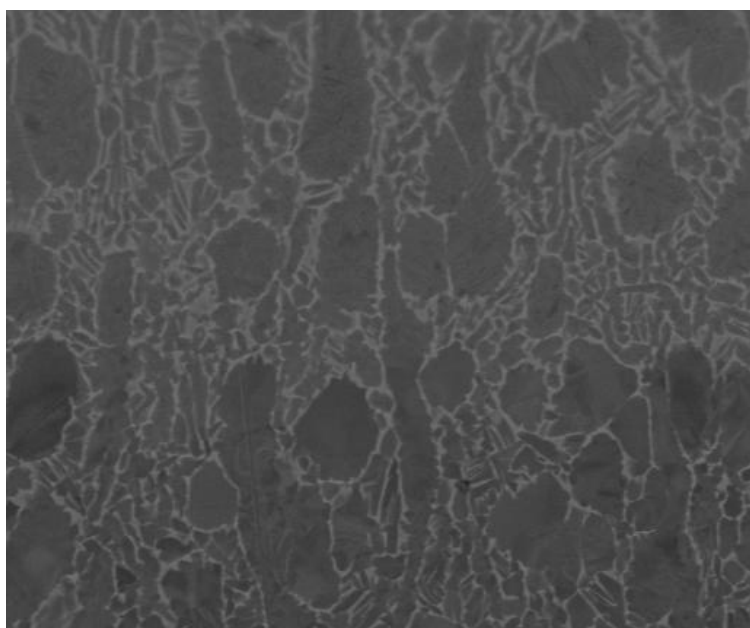


Figure 1

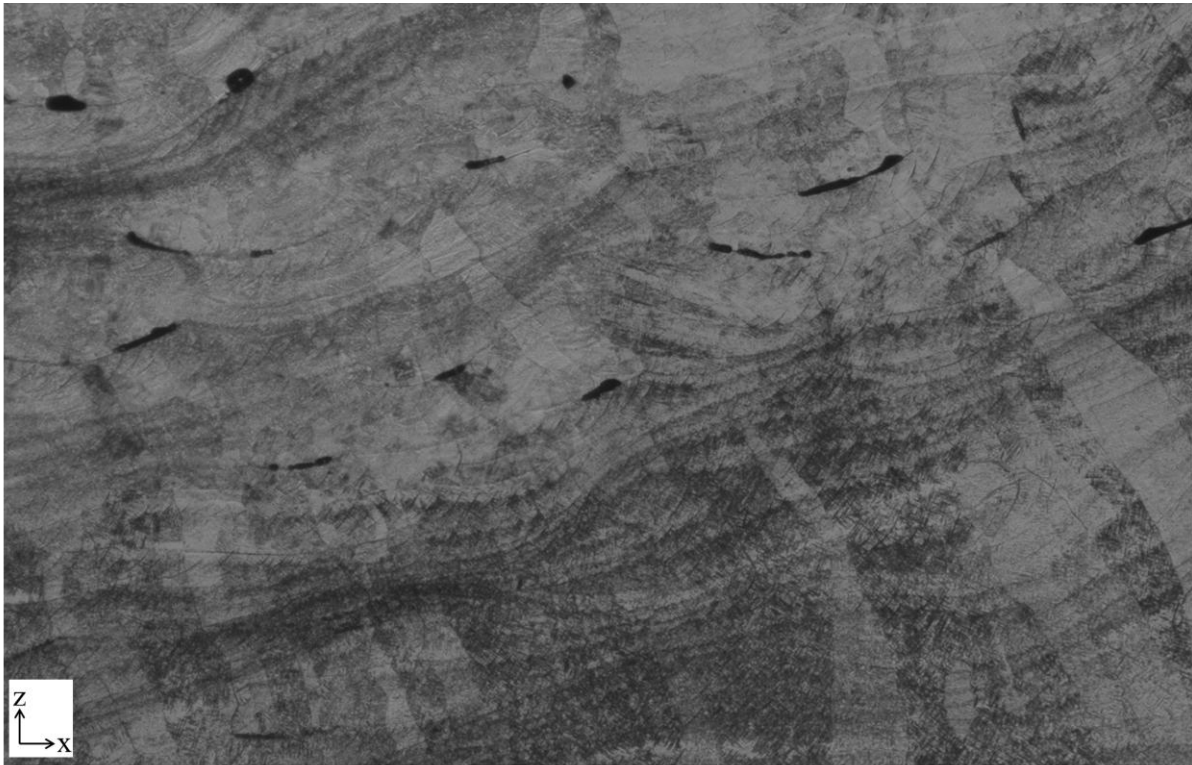


**Figure 2**



20  $\mu\text{m}$

**Figure 3**



200  $\mu\text{m}$

Figure 4

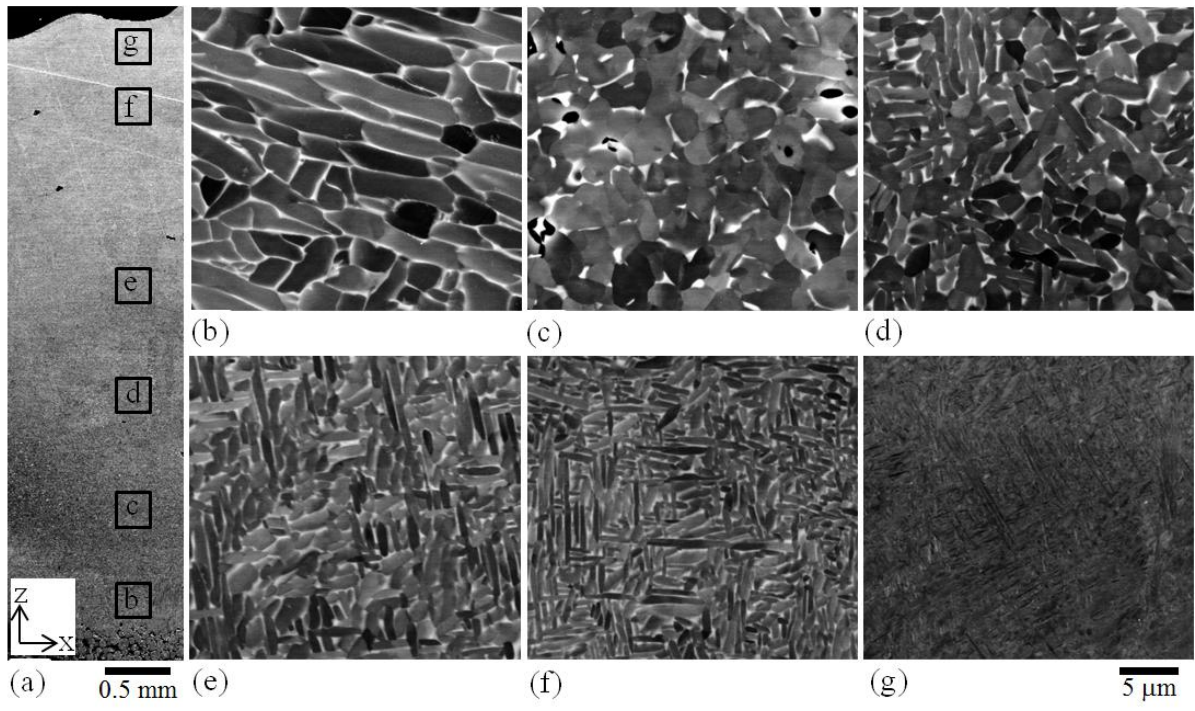
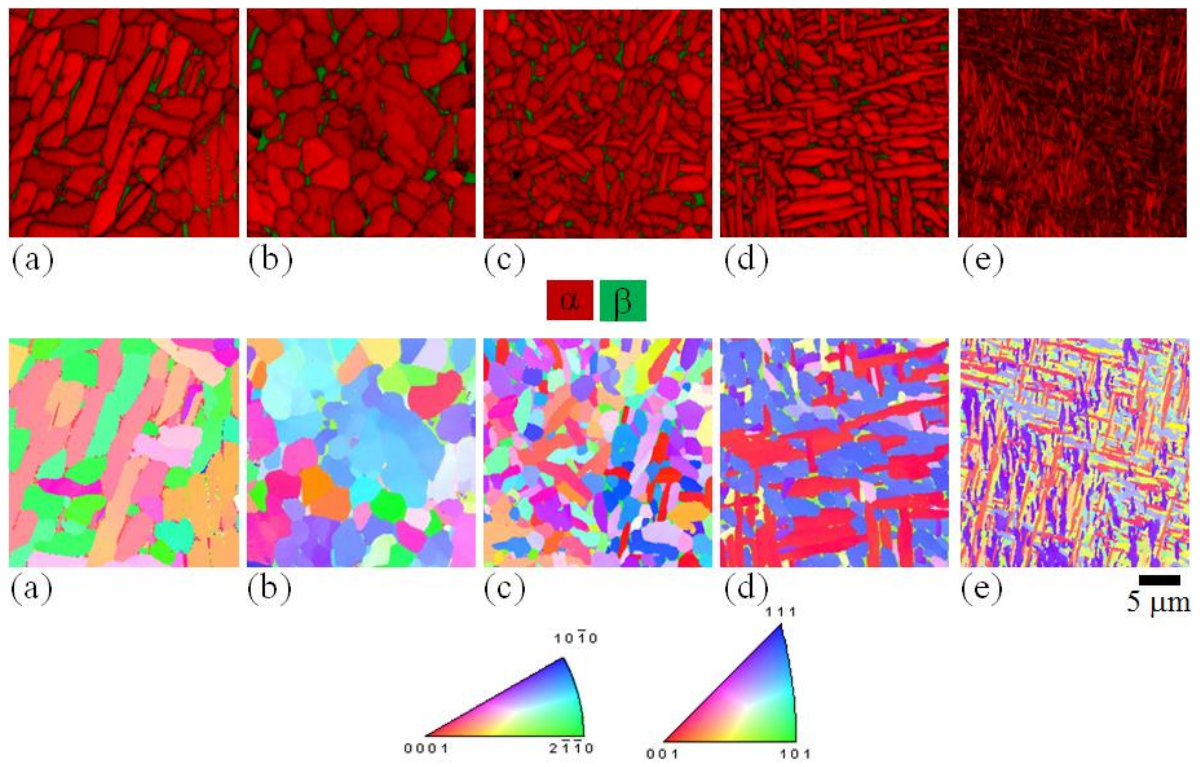
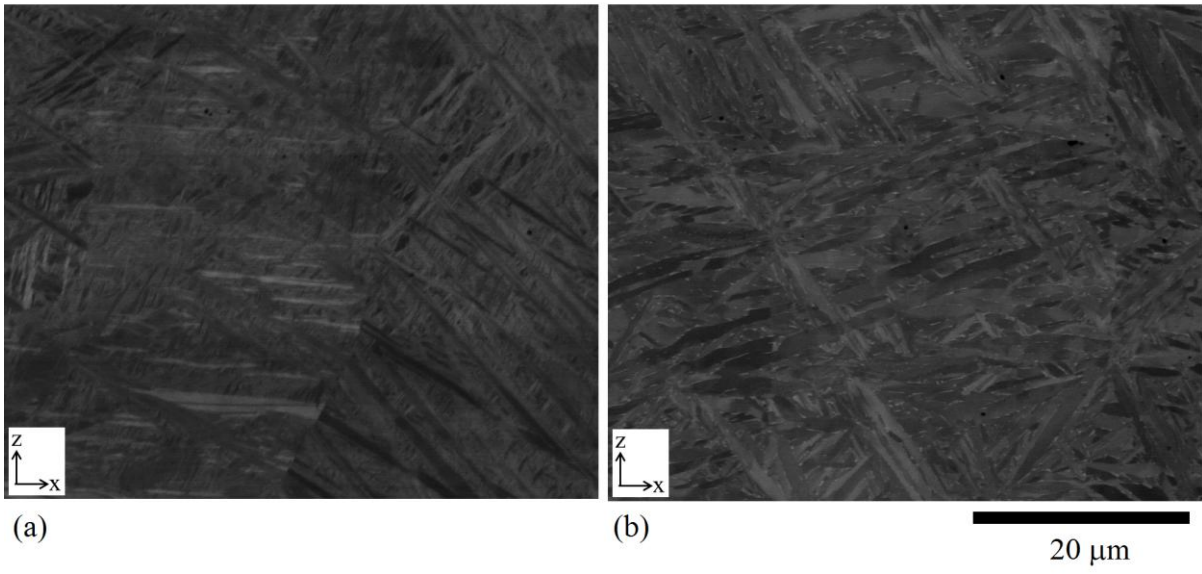


Figure 5

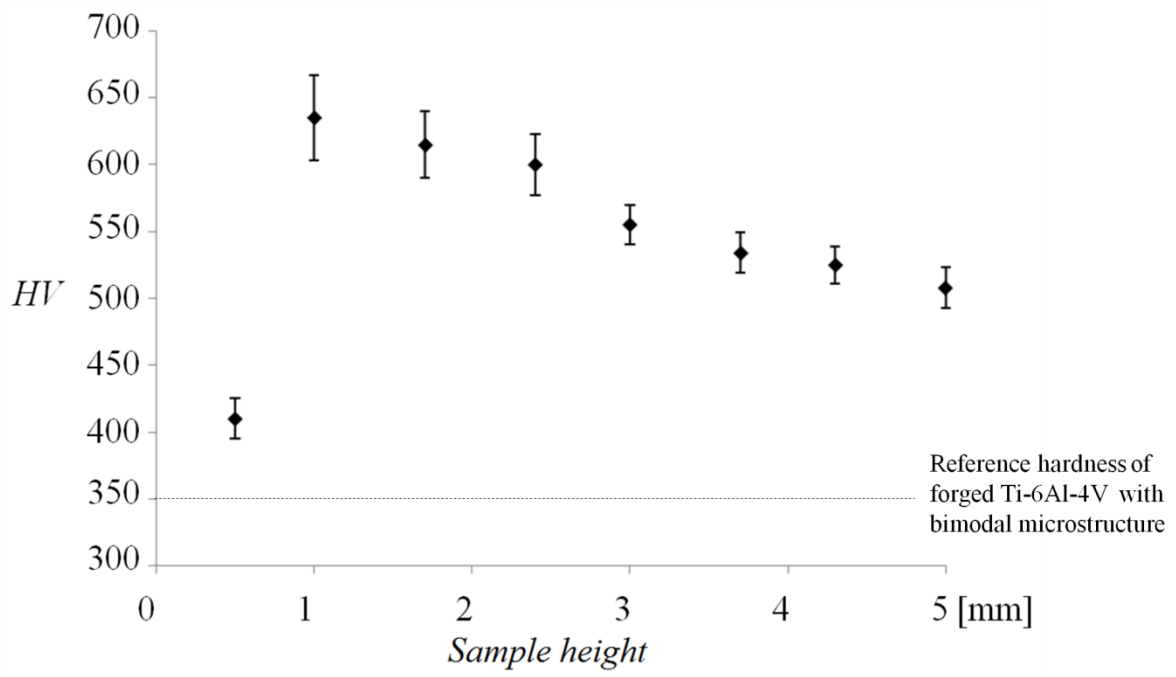




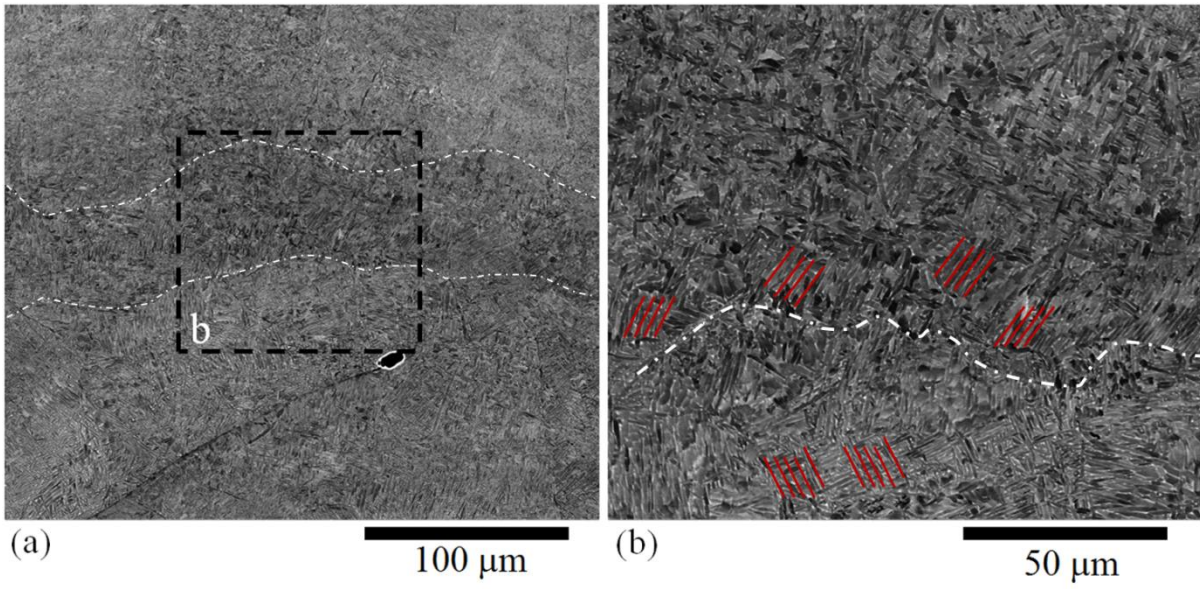
**Figure 6**



**Figure 7**



**Figure 8**





**Table 1**

**Table 1:** Chemical composition of the powders used in this study

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<b>Element</b>	<b>N</b>	<b>C</b>	<b>H</b>	<b>Fe</b>	<b>O</b>	<b>Al</b>	<b>V</b>	<b>Ti</b>
<b>wt%</b>	0.01	0.01	0.0051	0.25	0.13	6.5	4.5	balance

**Table 2**

**Table 2:** Comparison of the process parameters used in this research and those typical used for SLM of Ti-6Al-4V

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	<b>Present research</b>	[ref 4]	[ref 5]	[ref 8]	[ref 10]
Laser Power [W]	<b>42</b>	200	100	42	157
Hatch Spacing [ $\mu\text{m}$ ]	<b>30</b>	200	100	75	100
Scan Speed [mm/s]	<b>58</b>	500	150	200	225
Platform Temperature [K]	<b>473</b>	773	n/a	n/a	343
Oxygen Level [%]	<b><math>2 \times 10^{-4}</math></b>	$< 1 \times 10^{-2}$	n/a	n/a	$5 \times 10^{-4}$
Scan Strategy	<b>double</b>	Single	Single	Single	Single
Layer Thickness [ $\mu\text{m}$ ]	<b>50</b>	30	50	30	50
Spot Size [ $\mu\text{m}$ ]	<b>30</b>	220	180	52	120
Part Size [order]	<b>mm</b>	mm	mm	mm	mm

**Table 3**

**Table 3:** Chemical composition (weight %) of the different microstructures observed in the SLM Ti-6Al-4V and the reference material.

	<b>Average area</b>	<b><math>\alpha</math> phase</b>	<b><math>\beta</math> phase</b>		<b>Morphology</b>	<b>Sample height</b>
Ti	90.7 $\pm$ 0.1	91.7 $\pm$ 0.1	88.6 $\pm$ 0.2		lamellar	0.5 mm
Al	5.3 $\pm$ 0.1	5.8 $\pm$ 0.1	3.6 $\pm$ 0.1			
V	4.0 $\pm$ 0.1	2.5 $\pm$ 0.4	7.8 $\pm$ 0.3			
	<b>Average area</b>	<b><math>\alpha</math> phase</b>	<b><math>\beta</math> phase</b>		equiaxed	1.5 mm
Ti	90.0 $\pm$ 0.1	93.5 $\pm$ 0.5	75.5 $\pm$ 0.5			
Al	5.4 $\pm$ 0.1	4.5 $\pm$ 0.4	7.4 $\pm$ 0.2			
V	4.6 $\pm$ 0.1	2.0 $\pm$ 0.3	17.1 $\pm$ 0.5			
	<b>Average area</b>	<b><math>\alpha_{\text{lamellar}}</math> phase</b>	<b><math>\beta</math> phase</b>	<b><math>\alpha_{\text{equiaxed}}</math> phase</b>	bimodal	3 mm
Ti	90.0 $\pm$ 0.1	92.0 $\pm$ 0.7	87.0 $\pm$ 0.9	93.5 $\pm$ 0.7		
Al	5.4 $\pm$ 0.1	6.0 $\pm$ 0.4	5.1 $\pm$ 0.5	4.4 $\pm$ 0.4		
V	4.6 $\pm$ 0.1	2.0 $\pm$ 0.2	7.9 $\pm$ 0.2	2.1 $\pm$ 0.2		
	<b>Average area</b>	<b><math>\alpha'</math> phase</b>			martensite (fine lamellar)	5 mm
Ti	87.4 $\pm$ 0.4	87.3 $\pm$ 0.7				
Al	8.8 $\pm$ 0.2	8.7 $\pm$ 0.1				
V	3.8 $\pm$ 0.3	4.0 $\pm$ 0.7				
	<b>Average area</b>	<b><math>\alpha_{\text{equiaxed}}</math> phase</b>	<b><math>\beta</math> phase</b>		reference forged Ti-6Al-4V with bimodal microstructure	
Ti	85.3 $\pm$ 0.4	87.2 $\pm$ 0.5	81.5 $\pm$ 1.1			
Al	6.4 $\pm$ 0.3	11.0 $\pm$ 0.5	6.4 $\pm$ 0.3			
V	3.9 $\pm$ 0.3	1.8 $\pm$ 0.5	12.1 $\pm$ 0.9			

**Table 4**

**Table 4:** Tensile properties of as-built and stress relieved SLM Ti-6Al-4V (zx-orientation)

	<b>E [GPa]</b>	<b><math>\sigma_y</math> [MPa]</b>	<b>UTS [MPa]</b>	<b><math>\epsilon</math> fracture [%]</b>
as-built	$119 \pm 7$	$967 \pm 10$	$1117 \pm 3$	$8.9 \pm 0.4$
stress relieved	$117 \pm 6$	$937 \pm 9$	$1052 \pm 11$	$9.6 \pm 0.9$