LaserForm® Ti Gr5 (A)

Titanium alloy fine-tuned for use with ProX DMP 320 metal powder producing technical and medical applications because of its highstrength, low density and its excellent biocompatibility. The essential difference between Ti6Al4V ELI (grade 23) and Ti6Al4V (grade 5) is the allowed higher oxygen and iron content in Ti Gr5. This confers improved strength.

LaserForm Ti Gr5 (A) is formulated and fine-tuned specifically for 3D Systems DMP 320 metal 3D Printers to deliver highest part quality and best part properties. The print parameter database that 3D Systems provides together with the material has been extensively developed, tested and optimized in 3D Systems' part production facilities that hold the unique expertise of printing 500,000 challenging production parts year over year. Based on over 1000 test samples the below listed part quality data and mechanical properties give you high planning security. And for a 24/7 production 3D Systems' thorough Supplier Quality Management System guarantees consistent, monitored material quality for reliable process results.

Material Description

This titanium alloy is commonly used for lightweight and high-strength components such as aerospace and motor sports applications. Because of its excellent biocompatibility Ti Gr5 (A) is also very well suited for medical implants, tools and devices and dental prostheses. The essential difference between Ti6Al4V ELI (grade 23) and Ti6Al4V (grade 5) is the allowed higher oxygen and iron content in Ti Gr5. This confers improved strength while slightly reducing ductility.

These benefits make LaserForm Ti Gr5 (A) the ideal material for light-weight, high-strength components as required for a broad scope of parts in aerospace, sports and marine products. Its high strength and biocompatibility make it the material of choice for medical tools and devices.

Classification

Parts built with LaserForm Ti Gr5 Alloy have a chemical composition that meets the requirements of ASTM B265, B348 (grade 5), F2924, ISO 5832-3 and Werkstoff Nr. 3.7165.

Mechanical Properties[1,2,5]

MEASUREMENT	CONDITION	METRIC		U.S.	
		AFTER STRESS RELIEF	AFTER HIP	AFTER STRESS RELIEF	AFTER HIP
Youngs modulus (GPa | ksi)[4]		105-120	105-120	15000-17500	15000-17500
Ultimate Strength (MPa | ksi)	ASTM E8M				
Horizontal direction — XY Vertical direction — Z		1180 ± 30 1160 ± 50	1000 ± 30 1020 ± 50	171 ± 5 168 ± 8	145 ± 5 148 ± 8
Yield strength Rp0.2% (MPa | ksi)	ASTM E8M				
Horizontal direction — XY Vertical direction — Z		1090 ± 30 1080 ± 50	910 ± 20 930 ± 20	158 ± 4 157 ± 4	132 ± 1 134 ± 1
Elongation at break (%)	ASTM E8M				
Horizontal direction — XY Vertical direction — Z		9 ± 2 9 ± 2	15 ± 3 14 ± 3	9 ± 2 9 ± 2	15 ± 3 14 ± 3
Hardness, Rockwell B		40 ± 2	36 ± 2	40 ± 2	36 ± 2
Impact toughness (J/cm² | lb.ft)[3]	ASTM E23	min 20	20 ± 2	min 15	15 ± 2

Thermal Properties[6]

MEASUREMENT	CONDITION	METRIC	U.S.
Thermal conductivity (W/(m.K) | BTU-in/(h-ft²-°F)	At 50 °C/ 120 °F	6.7	46.5
Coefficient of Thermal Expansion (µm/m-°C / µm/in-°F)	In the range of 20 to 100 °C	8.6	4.8
Melting range (°C | °F)		1692-1698	3046-3056

[1] Parts manufactured with standard parameters on a ProX DMP 320, Config A
[2] HIP indicate hot isostatic pressing post treatment
[3] Tested with charpy V-notch toughness test, DMV probe
[4] Values based on minimum and maximum ranges
[5] Values based on average and standard deviation
[6] Values based on literature

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Physical Properties

MEASUREMENT	CONDITION	METRIC		U.S.	
		AS BUILT AND AFTER STRESS RELIEF	AFTER HIP	AS BUILT AND AFTER STRESS	AFTER HIP
Density — Relative, based on pixelcount (%)	Optical method	> 99.9		> 99.9	
Density — Absolute theoretical[6] (g/cm^3 | lb/in^3)		4.42		0.159	

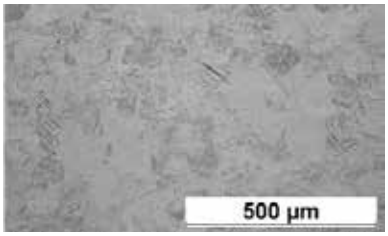
Surface Quality

MEASUREMENT	METRIC	U.S.
	SANDBLASTED	SANDBLASTED
Surface Roughness[4]		
Horizontal direction (XY) (µm | µin) Vertical direction (Z) (µm | µin)	4-8 4-8	4-8 4-8

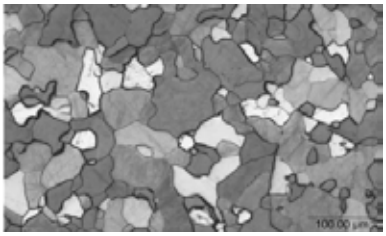
Chemical Composition

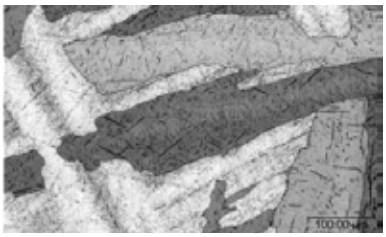
Ti	bal.
N	≤0.05
c	≤0.08
H	≤0.015
Fe	≤0.30
O	≤0.20
Al	5.50-6.75
V	3.50-4.50
Y	≤0.005
residuals each	≤0.10
residuals total	≤0.40

[4] Values based on minimum and maximum ranges
[6] Values based on literature



Microstructure as built


Microstructure after stress relief


Microstructure after HIP

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