GE Additive

Ti64 Grade 23

With appropriate approval* Ti64 Grade 23 can be used for the production of lightweight components in the field of motorsport and aerospace industries as well as implants in the medical technology field.

Data in this document represents material built with 60 µm layer thickness and in an Argon atmosphere on an M2 / M2 Multilaser machine. Values listed are typical.

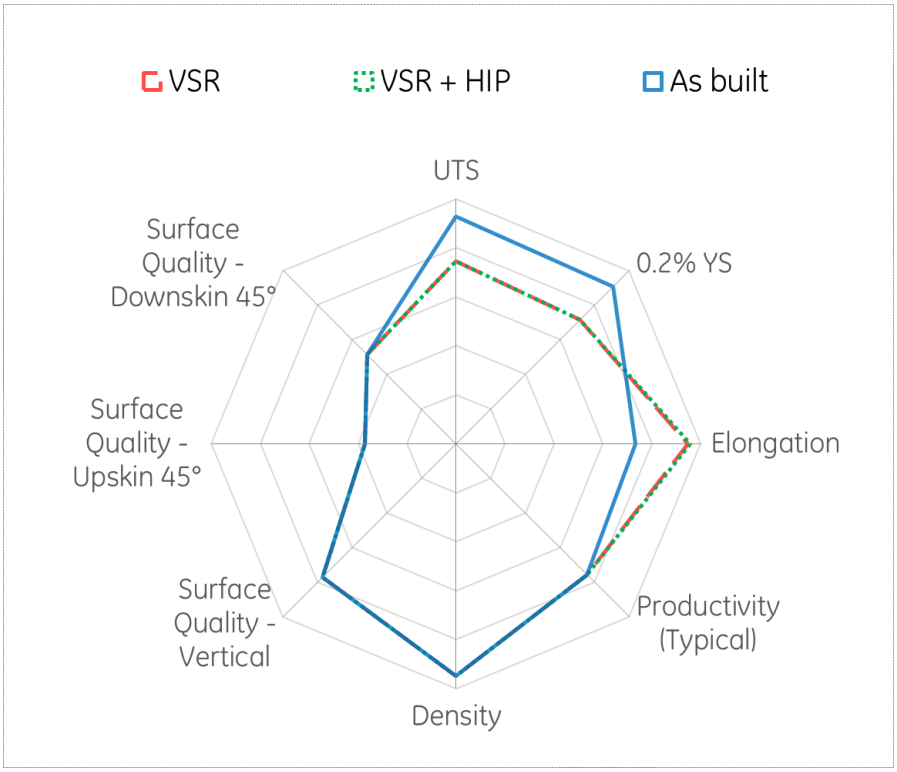
22
Ti

POWDER CHEMISTRY

Element	Indicative value (wt%)
Al	5.5-6.5
V	3.5-4.5
Fe	0-0.25
C	0-0.08
O	0-0.13
N	0-0.05
H	0-0.012
Ti	Balance

Ti64 Grade 23 (powder) chemical composition et al. according to **ASTM F136-02a** (ELI Grade 23).

SPIDER PLOT



MACHINE CONFIGURATION

- M2 / M2 Multilaser
- Argon Gas
- Steel blade
- Layer thickness 60µm
- Build rate dual laser w/ coating *[cm³/h] : 26.5
- Max. Build rate per Laser** [cm³/h]: 40.4

*Measured by using Factory Acceptance Test layout
**Calculated (layer thickness x scan velocity x hatch distance)

THERMAL STATES

1. AS BUILT
2. VACUUM STRESS RELIEF (VSR): 900°C, 1 hour in vacuum
3. VACUUM STRESS RELIEF + HOT ISOSTATIC PRESS. (VSR+HIP)
   VSR: 730°C, 1 hour in vacuum, HIP: 900°C, 2 hours at 100MPa

PHYSICAL DATA AT ROOM TEMPERATURE

	Surface Roughness - Overhang (µm)		
	45°	60°	75°
Upskin	27	24	20
Downksin	22	13	11

	Surface Roughness (µm)
H	22
V	13

	Porosity (% Density)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.95	99.95	354	--	--	--
Stress Relief	--	--	--	--	0.301	0.329
VSR+HIP	--	--	--	--	0.349	0.349

HORIZONTAL

Thermal State	Thermal Conductivity (W/m•K)	Coeff. Of Thermal Expansion (m/m/°C)	Thermal Diffusivity (m^2/s)	Specific Heat (J/K•kg)
As-Built	--	--	--	--
Stress Relief	6.5	8.8×10^{-6}	2.5×10^{-6}	586
VSR+HIP	6.1	8.7×10^{-6}	2.5×10^{-6}	561

VERTICAL

Thermal State	Thermal Conductivity (W/m•K)	Coeff. Of Thermal Expansion (mm/mm/°C)	Thermal Diffusivity (m^2/s)	Specific Heat (J/K•kg)
As-Built	--	--	--	--
Stress Relief	6.4	8.6×10^{-6}	2.5×10^{-6}	586
VSR+HIP	6.0	8.7×10^{-6}	2.5×10^{-6}	561

TENSILE DATA

Tensile testing done in accordance with ASTM E8 and ASTM E21

Temperature: RT

	Modulus of Elasticity (GPa)		0.2% YS (MPa)		UTS (MPa)		Elongation (%)		Reduction of Area (%)	
Thermal State	H	V	H	V	H	V	H	V	H	V
As-Built	--	--	1120	1145	1245	1260	9	9	29	28
Stress Relief	--	--	890	895	1005	1005	17	17	49	47
Stress Relief+HIP	--	--	885	905	1005	1005	17	18	43	44

Temperature: 200°C

	Modulus of Elasticity (GPa)		0.2% YS (MPa)		UTS (MPa)		Elongation (%)		Reduction of Area (%)	
Thermal State	H	V	H	V	H	V	H	V	H	V
As-Built	--	--	895	935	1045	1075	17	17	59	54
Stress Relief	--	--	670	685	815	835	21	21	69	66
Stress Relief+HIP	--	--	665	675	805	820	21	21	65	58

H: HORIZONTAL (XY) orientation
V: VERTICAL (Z) orientation

* All of the figures contained herein are approximate only. The figures provided are dependent on a number of factors, including but not limited to, process and machine parameters, and the approval is brand specific and/or application specific. The information provided on this material data sheet is illustrative only and cannot be relied on as binding.

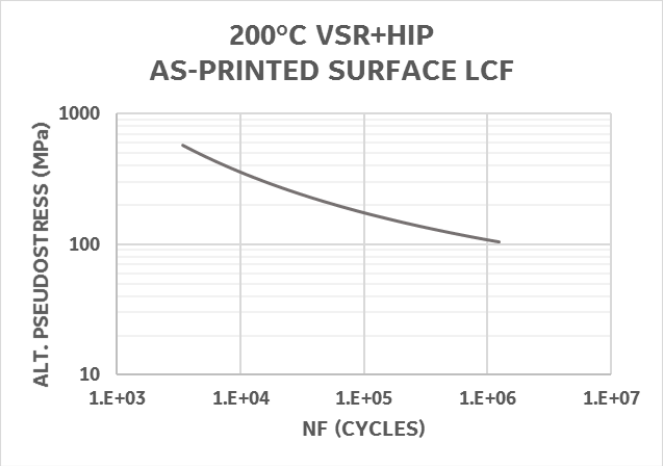
LOW CYCLE FATIGUE DATA (STRAIN-CONTROLLED)

LCF testing done in accordance with ASTM E606

Test Frequency: 0.5 Hz for 24 hrs; 9 Hz in load-control >24 hrs per ASTM E606

R-Ratio: 0
Temperature: RT

	AS-PRINTED SURFACE				MACHINED SURFACE			
	Alt Stress at 1E5 cycles (MPa)		Alt Stress at 1E6 cycles (MPa)		Alt Stress at 1E5 cycles (MPa)		Alt Stress at 1E6 cycles (MPa)	
Thermal State	H	V	H	V	H	V	H	V
VSR+HIP	173	173	107	107	--	--	--	--



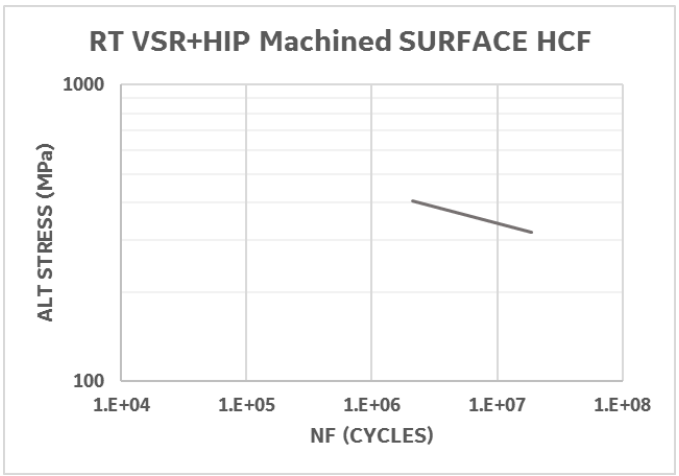
HIGH CYCLE FATIGUE DATA (LOAD-CONTROLLED)

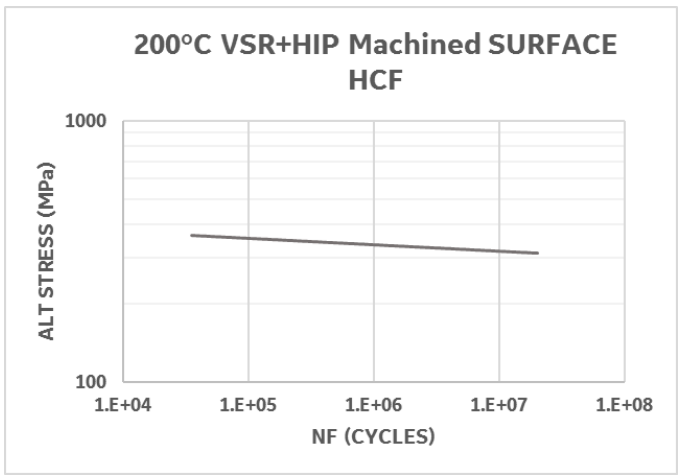
HCF testing done in accordance with ASTM E466

Test Frequency: 60 Hz

R-Ratio: 0
Temperature:
RT / 200°C

		AS-PRINTED SURFACE Alt Stress at 1E7 cycles (MPa)		MACHINED SURFACE Alt Stress at 1E7 cycles (MPa)	
Thermal State	**Test Temperature**	H	V	H	V
VSR+HIP	RT	--	--	342	342
VSR+HIP	200°C	--	--	318	318





H: HORIZONTAL (XY) orientation
V: VERTICAL (Z) orientation

* All of the figures contained herein are approximate only. The figures provided are dependent on a number of factors, including but not limited to, process and machine parameters, and the approval is brand specific and/or application specific. The information provided on this material data sheet is illustrative only and cannot be relied on as binding.