

MATERIAL Database

For AM / DED / Metal 3D Printing

Material Info.

Fe [Tool Steel] P20 / P21 / H13
[Stainless Steel] SS304L / SS316L / SS420J2 / SDSS2507

Ti Ti-6Al-4V

Ni Inconel625 / Inconel718 / Hastelloy22 / Invar36

Co CoCr Mp1 / Stellite25

Cu Al-bronze

Nb C-103



P20 / UNS T51620 / DIN 1.2311



Key Features

- Excellent Toughness
- Excellent Weldability
- Excellent Machinability
- Glossy Finish

Introduction of Material

- Since it is heat-treated and supplied with mold steel having good toughness, additional heat treatment is not required
- It is a multipurpose engineering material with excellent weldability and machinability
- It has a high impact strength

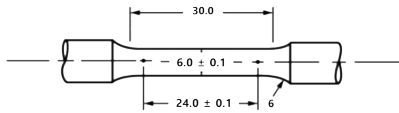
Application

- Die & Mold
- Bolster

Chemical Composition

UNS T51620	Fe	Cr	Mo	Mn	Si	P	S	C
Weight Percent(wt%)	Bal.	1.4-2.0	0.3-0.55	0.6-1.0	0.2-0.8	Max 0.03	Max 0.03	0.28-0.4

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
Casting	1100-1300	1000-1200	> 14	> 45	37-41
InssTek (DMT®)XY / Z	1283 / 1219	1103 / 921	13 / 12	25 / 16	38.5

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3)
		Min	Flow Time for Mass (s/50g)
		Max	Flow Rate for Volume (s/cm3)
			4.31
			17.28
			1.49

Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	20.6	108.33	126.43
	M/P	Ra	Rz	Rt
	②	13.03	68.27	97.37

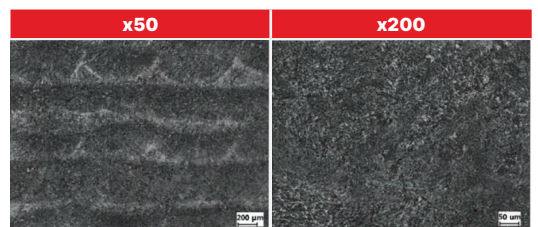
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 7.850
	[DED] 7.712

Melting Point

Celsius (°C)	Fahrenheit (°F)
1420-1460	2580-2660

Microstructure



P21 / UNS T51621 / DIN 1.2278



Key Features

- Excellent Ductility
- Excellent Surface Hardness
- Excellent Machinability

Introduction of Material

- Typical plastic injection mold steel
- The thermal resistance is high, and the dimensional change is small. However, the cooling efficiency is not good due to low thermal conductivity
- It have a high machinability, thus suitable for surface of part
- It have high ductility and hardness, thus suitable for high-precision plastic mold

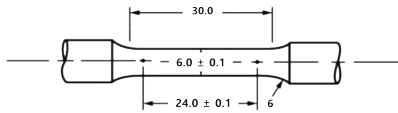
Application

- Die & Mold

Chemical Composition

UNS T51621	Fe	Ni	Cr	Al	V	Mn	Si	P	S	C
Weight Percent(wt%)	Bal.	3.9-4.25	0.2 - 0.3	1.05 - 1.25	0.15 - 0.25	0.2 - 0.4	0.2 - 0.4	Max 0.03	Max 0.03	0.18 - 0.22

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
Casting	1130	1000-1200	> 14	> 45	35
InssTek (DMT®)XY / Z	1051 / 970	923 / 858	20 / 21	63 / 61	32.55

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]			
		Powder Size (µm)	Flowability [ASTM B213 / B212]		
		Avg	70.49	Apparent Density (g/cm3)	3.26
		Min	36.21	Flow Time for Mass (s/50g)	23.58
		Max	127.60	Flow Rate for Volume (s/cm3)	1.54

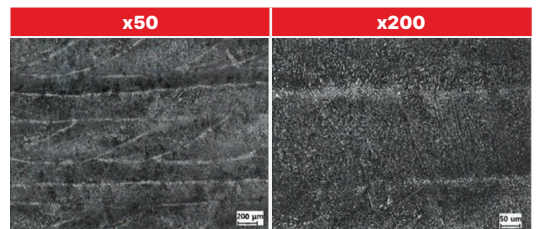
Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	v	Rt	M/P	Ra	Rz	Rt
	①	12.73	61.39	81.6	②	8.94	42.75	62.8

Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 7.700
	[DED] 7.648

Microstructure



Melting Point

Celsius (°C)	Fahrenheit (°F)
1410-1450	2580-2650

H13 / UNS T20813 / DIN 1.2344

Key Features

- Excellent Wear Resistance
- Thermal Fatigue Resistance
- Dimensional Stability
- High Hardnability
- Excellent Ductility & Toughness

Introduction of Material

- It is also called SKD61 or hot tool steel
- It is excellent in abrasion resistance and thermal fatigue resistance at high temperature
- It has excellent toughness and ductility in the rolling direction, and Z direction
- It is mainly used for large size molds

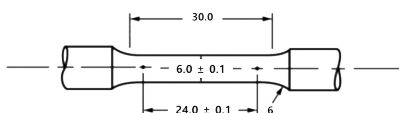
Application

- Forging Press
- Diecasting

Chemical Composition

UNS T20813	Fe	Cr	Mo	V	Mn	Si	P	S	C
Weight Percent(wt%)	Bal.	4.75 - 5.5	1.1 - 1.75	0.8 - 1.2	0.2 - 0.6	0.8 - 1.25	Max 0.03	Max 0.03	0.32 - 0.45

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
ASTM A597	Min. 949	Min. 727	31	42	223HBW
Casting	1990	1650	9	50	55
InssTek (DMT®)XY / Z	1675 / 1845	1037 / 1141	2.4 / 2.9	2 / 1	58.3

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3) 4.20
		Min	Flow Time for Mass (s/50g) 16.80
		Max	Flow Rate for Volume (s/cm3) 1.41

Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	16.49	91.94	124.54	②	11.67	68.91	107.81

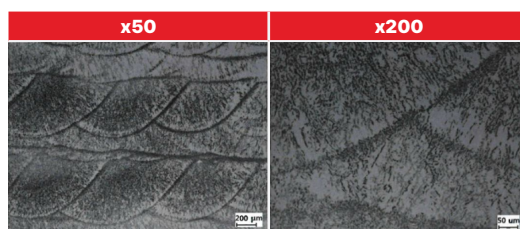
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 7,800
	[DED] 7,639

Melting Point

Celsius (°C)	Fahrenheit (°F)
1420-1460	2580-2660

Microstructure



SS304L / UNS S30403 / DIN 1.4307



Key Features

- Excellent Formability
- Excellent Weldability
- Excellent Corrosion Resistance
- Non-Magnetic

Introduction of Material

- Most commonly used austenitic stainless steel
- Also called 18/8 stainless steel, it has excellent moldability and weldability
- It has excellent corrosion resistance and strength, and good drawability
- Unlike SS302, it can be used without annealing
- It is commonly used in the food industry, such as brewing, milk processing, and wine making

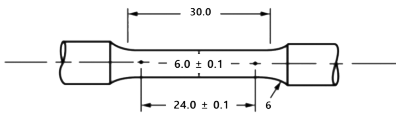
Application

- Utensils
- Heat Exchanger
- Mining Equipment
- Construction
- Chemical Container

Chemical Composition

UNS S30403	Fe	Cr	Ni	Mo	Mn	Si	N	P	S	C
Weight Percent(wt%)	Bal.	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	Max 2.0	Max 0.75	Max 0.1	0.045	0.03	Max 0.03

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRB)
ASTM A743	Min. 485	Min. 205	Min. 30	Min. 40	Max. 92
Casting	592 / 593	214 / 224	57 / 57	81 / 84	-
Forging	651 / 760	470 / 555	55 / 35	84 / 43	-
InssTek (DMT®)XY / Z	667 / 609	435 / 373	46 / 33	61 / 32	87.5

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3) 4.19
		Min	Flow Time for Mass (s/50g) 17.00
		Max	Flow Rate for Volume (s/cm3) 1.42

Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	14.49	84.42	118.17	②	13.82	73.24	95.32

Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 8.000
	[DED] 7.938

Melting Point

Celsius (°C)	Fahrenheit (°F)
1399-1454	2550-2650

Microstructure



SS316L / UNS S31603 / DIN 1.4404

Key Features

- High Ductility
- High Strength
- Excellent Machinability & Formability
- Excellent Corrosion Resistance
- Non-Magnetic

Introduction of Material

- Most commonly used austenitic stainless steel
- To prevent Cr carbide precipitation by lowering the C content below 0.03
- It has excellent mechanical properties, corrosion resistance, weldability, etc
- It is made by adding 2~3% of Mo in SS304 to improve corrosion resistance to seawater
- It has excellent creep strength at high temperatures

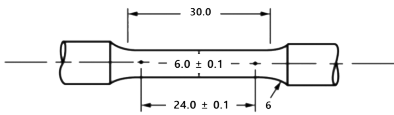
Application

- Chemical Industry
- Medical Industry
- Maritime Industry
- Food Industry
- Flange, Valve, Pump

Chemical Composition

UNS S31603	Fe	Cr	Ni	Mo	Mn	Si	N	P	S	C
Weight Percent(wt%)	Bal.	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	Max 2.0	Max 0.75	Max 0.1	0.045	0.03	Max 0.03

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardnes (Hv)
ASTM A743	Min. 485	Min. 205	Min. 30	-	-
Casting	503 / 515	274 / 275	52 / 63	77 / 88	155
Forging	581 / 588	266 / 296	66 / 71	80 / 83	151
InssTek (DMT®)XY / Z	573 / 575	419 / 450	35 / 36	40 / 45	182

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	83.16
		Min	44.81
		Max	162.80
		Apparent Density (g/cm3)	4.64
		Flow Time for Mass (s/50g)	12.58
		Flow Rate for Volume (s/cm3)	1.17

Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	13.4	84.01	127.26
	M/P	Ra	Rz	Rt
	②	16.07	60.45	68.14

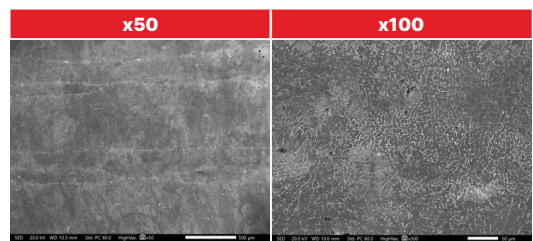
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 8.000
	[DED] 7.789

Melting Point

Celsius (°C)	Fahrenheit (°F)
1371-1421	2500-2590

Microstructure



SS420J2 / UNS S42000 / DIN 1.2083



Key Features

- High Strength & Hardness
- Excellent Wear Resistance
- Magnetic

Introduction of Material

- Most commonly used martensite stainless steel
- It is steel with improved and wear resistance by increasing Cr in SS410
- Due to the high C content and the absence of Ni, it has better corrosion resistance than ordinary alloy steel
- But vulnerable to sea water

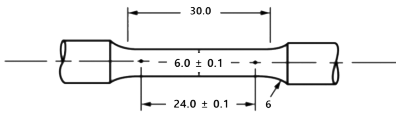
Application

- Shear Blade
- Needle Valve
- Die & Mold
- Sharf

Chemical Composition

UNS S42000	Fe	Cr	Mn	Si	P	S	C
Weight Percent(wt%)	Bal.	12.0-14.0	Max 1.0	Max 1.0	Max 0.04	Max 0.03	Min 0.15

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
ASTM A743	Min. 690	Min. 485	Min. 15	Min. 25	Max. 56
Casting	689 / 931	517 / 793	17 / 30	55 / 60	-
Forging	655 / 700	345 / 495	25 / 30	55	-
InssTek (DMT®)XY / Z	1470 / 1665	737 / 830	2 / 2	1 / 1	56.6

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3) 4.22
		Min	Flow Time for Mass (s/50g) 17.16
		Max	Flow Rate for Volume (s/cm3) 1.45

Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	17.4	92.63	109.87	②	20.59	114.49	129.13

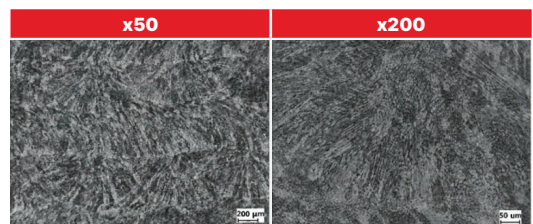
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 7.800
	[DED] 7.629

Melting Point

Celsius (°C)	Fahrenheit (°F)
1470-1510	2678-2750

Microstructure



Super Duplex 2507 / UNS S32750 / DIN 1.4410

Key Features

- Excellent Corrosion Resistance
- Excellent Strength
- Excellent Weldability
- Magnetic

Introduction of Material

- Austenite and ferrite two-phase microstructure with the advantages of both steels
- Among these 2507 is called as super duplex steels
- It has excellent resistance to stress corrosion cracking and high strength
- It is highly resistance to corrosion that occurs in various environments
- Low thermal expansion coefficient, excellent weldability, and low cost of periodic replacement is advantage

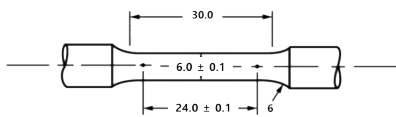
Application

- Oil & Gas Industry
- Maritime Industry
- Pressure Vessel for Chemical Process
- Heat Exchanger

Chemical Composition

UNS S32750	Fe	Cr	Ni	Mo	Mn	Si	N	P	S	C	Cu
Weight Percent(wt%)	Bal.	24.0-26.0	6.0-8.0	3.0-5.0	Max 1.2	Max 0.8	0.24-0.32	Max 0.035	Max 0.02	Max 0.03	Max 0.5

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
UNS S32750	Min. 689	Min. 517	Min. 18	48	Max. 32
Casting	690 / 770	515 / 590	18 / 20	-	-
Forging	730 / 800	515 / 550	15 / 15	-	-
InssTek (DMT®)XY / Z	1013 / 1014	859 / 841	24 / 26	64 / 66	28.4

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm ³)
		Min	Flow Time for Mass (s/50g)
		Max	Flow Rate for Volume (s/cm ³)
			4.43
			13.64
			1.21

Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	15.51	73.6	113.43	②	12.4	64.98	92.68

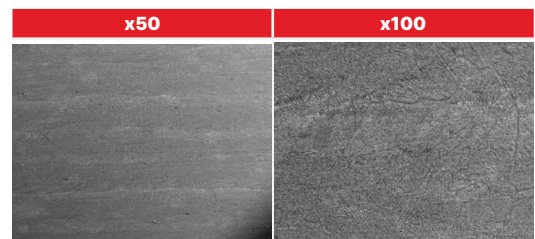
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 7.800
	[DED] 7.757

Melting Point

Celsius (°C)	Fahrenheit (°F)
1375-1450	2507-2642

Microstructure



Ti-6Al-4V / UNS R56400 / DIN 3.7165



Key Features

- High Specific Strength
- Excellent Biocompatibility
- Excellent Corrosion Resistance
- Excellent Formateness
- Excellent Fatigue Resistance in Light Metal

Introduction of Material

- As the most common Ti alloy, Grade 5 is a representative one
- It is used in aviation and medical fields based on excellent biocompatibility and corrosion resistance
- There is Grade 23, which further improves biocompatibility by lowering O concentrations
- Alloys with very low thermal conductivity at room temperature and varying microstructure depending on the heat treatment condition

Application

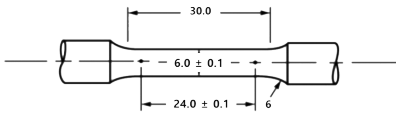
- Aerospace Part
- Automotive Part
- Medical Industry
- Maritime Industry

Chemical Composition

UNS R56400	Ti	Al	V	Fe	N	C	O	H
Weight Percent(wt%)	Bal.	5.5-6.75	3.5-4.5	Max 0.4	Max 0.05	Max 0.08	Max 0.2	Max 0.015

Mechanical Properties

* Test Method used ASTM E8/E8M-21



Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
ASTM B367	Min. 895	Min. 825	Min. 6	-	-
Casting	930 / 984	855 / 917	7.2 / 12	20 / 20	36
Forging	895 / 1103	828 / 1034	14.5 / 15.5	-	-
InssTek (DMT®)XY / Z	1141 / 1106	1036 / 993	7 / 14	14 / 29	38.5

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm ³)
		Min	Flow Time for Mass (s/50g)
		Max	Flow Rate for Volume (s/cm ³)
			2.59
			25.00
			1.30

Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	12.73	67.63	90.55
	M/P	Ra	Rz	Rt
	②	10.24	50.75	66.2

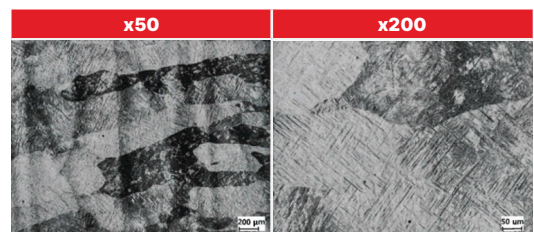
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 4.430
	[DED] 4.360

Melting Point

Celsius (°C)	Fahrenheit (°F)
1604-1660	1919-3020

Microstructure



Inconel 625 / UNS N06625 / DIN 2.4856

Key Features

- Excellent Corrosion Resistance
- Excellent Weldability
- Excellent Strength
- Excellent Heat Resistance

Introduction of Material

- It is alloy in which Nb is added to Ni-Cr-Mo and has high strength due to Mo and Nb
- It exhibits excellent resistance to stress corrosion cracking and various acids
- It is also highly resistance to nitriding and halogen, hydrogen chloride gas, etc
- Excellent weldability due to high resistance to corrosion between particles after welding and heat treatment

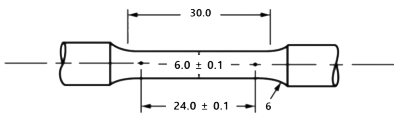
Application

- Maritime Industry
- Nuclear Industry
- Chemical Industry

Chemical Composition

UNS N06625	Ni	Cr	Mo	Nb + Ta	Co	Fe
Weight Percent (wt%)	Min 58.0	20.0-23.0	8.0-10.0	3.15-4.15	Max 1.0	Max 5.0

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (Hv)
ASTM A494	Min. 485	Min. 275	Min. 25	-	-
Casting	449 / 501	274 / 278	26 / 32	-	219
Forging	901 / 941	530 / 613	45 / 50	-	328
InssTek (DMT®)XY / Z	1002 / 1013	649 / 670	31 / 32	-	252

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm ³)
		Min	Flow Time for Mass (s/50g)
		Max	Flow Rate for Volume (s/cm ³)
			4.82
			12.33
			1.19

Roughness

Measuring Position	Roughness (µm)							
	Profile: R [LC GS 0.80 mm]		Profile: D					
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	13.08	74.72	90.92	②	9.79	45.11	59.8

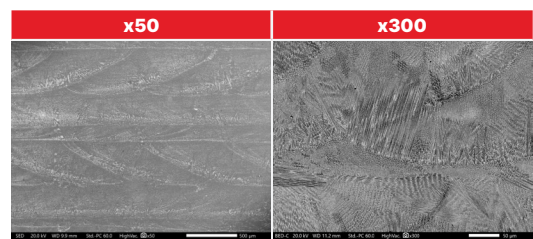
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 8.440
	[DED] 8.345

Melting Point

Celsius (°C)	Fahrenheit (°F)
1290-1350	2350-2460

Microstructure



Inconel 718 / UNS N07718 / DIN 2.4668



Key Features

- Excellent High Temperature Strength
- Excellent Corrosion Resistance (High Temp)
- Excellent Oxidation Resistance (High Temp)
- Excellent Weldability
- Excellent Machinability

Introduction of Material

- Precipitation hardening Ni-based alloys designed to exhibit exceptionally high yield, tensile and creep fracture properties at temperatures up to 704°C (1300°F)
- It is used in various fields for complex parts due to its excellent corrosion resistance, weldability and machinability

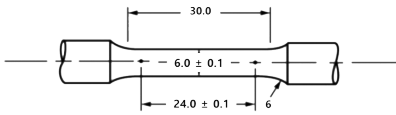
Application

- Extreme Low Temperature Tank
- Turbine Blade (Rocket, Gas)
- Chemical Industry
- Aircraft Engine

Chemical Composition

UNS N07718	Ni	Cr	Nb	Mo	Ti	Al	Mn	Si	C	S	Fe
Weight Percent (wt%)	50.0-55.0	17.0-21.0	4.75-5.50	2.8-3.3	0.65-1.15	0.3-0.7	Max 0.35	Max 0.35	0.02-0.08	Max 0.35	Bal.

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
Casting	827-1586	≥ 397	≥ 3	≥ 8	≥ 25
InssTek (DMT®)XY / Z	994 / 878	608 / 495	32 / 40	30 / 41	23.9

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm ³)
		Min	Flow Time for Mass (s/50g)
		Max	Flow Rate for Volume (s/cm ³)
			4.76
			12.86
			1.22

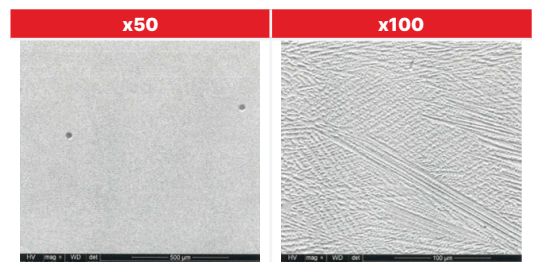
Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	9.85	62.02	102.77
	M/P	Ra	Rz	Rt
	②	9.07	49.65	54.8

Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 8.190
	[DED] 8.098

Microstructure



Melting Point

Celsius (°C)	Fahrenheit (°F)
1370-1430	2500-2600

Hastelloy 22 / UNS N06022 / DIN 2.4602



Key Features

- Excellent Corrosion Resistance
- Excellent Oxidation Resistance
- Aqueous Corrosion Resistance (High Temp)

Introduction of Material

- Multi-purpose austenite Ni-Cr-Mo alloy with excellent overall corrosion resistance to water corrosion at high temperatures
- Excellent resistance to common corrosion, hole, gap corrosion, grain boundary attack and stress corrosion cracking
- It tends to be strain hardened, thus difficult to machining and heat treatment and quick hardening are necessary

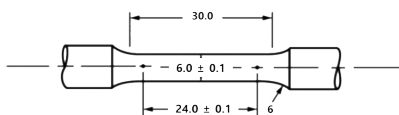
Application

- Chemical Industry
- Oil Industry
- Energy Industry
- Maritime Industry

Chemical Composition

UNS N06022	Ni	Cr	Mo	Fe	W	Co	C	Si	Mg	V	P	S
Weight Percent(wt%)	Bal.	20.0-22.5	12.5-14.5	2.0-6.0	2.5-3.5	Max 2.5	Max 0.015	Max 0.08	Max 0.5	Max 0.35	Max 0.02	Max 0.02

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
ASTM B574 / B575	690	310	45	-	184
Casting	765-1700	359-407	57-70	-	-
InssTek (DMT®)XY / Z	955 / 945.4	626 / 584.4	41 / 39.6	40.2 / 35.1	27.05

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]			
		Powder Size (µm)	Flowability [ASTM B213 / B212]		
		Avg	78.19	Apparent Density (g/cm³)	4.68
		Min	50.03	Flow Time for Mass (s/50g)	16.25
		Max	138.90	Flow Rate for Volume (s/cm³)	1.54

Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	16.35	79.22	94.89	②	10.73	49.55	69.65

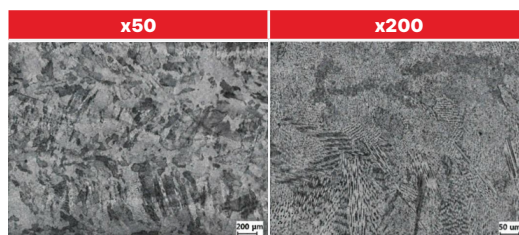
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 8.690
	[DED] 8.498

Melting Point

Celsius (°C)	Fahrenheit (°F)
1357-1399	2475-2550

Microstructure



Invar 36 / UNS K93600 / DIN 1.3912



Key Features

- Excellent Low Temperature Strength
- Excellent Low Temperature Toughness
- Almost 0 Thermal Expansion Coefficient

Introduction of Material

- It is a nickel-iron alloy containing 36% nickel and having a thermal expansion rate of about a tenth of a carbon steel
- The thermal expansion rate between (-250°C ~ +200°C) is very small
- Hot molding, cold molding, or machining processes are possible using similar process of austenitic stainless steel

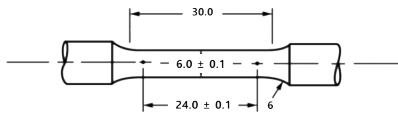
Application

- Extreme Low Temperature Environment
- Precision Instrument
- Low Expansion Part
- Liquid Gas Tank

Chemical Composition

UNS K93600	Fe	Ni	Cr	C	Mn	Si	Co	P	S	Al	Mg	Zr	Ti
Weight Percent (wt%)	Bal.	36.00	Max 0.25	Max 0.05	Max 0.60	Max 0.40	Max 0.50	Max 0.015	Max 0.015	Max 0.10	Max 0.10	Max 0.10	Max 0.10

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRB)
Casting	490	240	42	70	70
InssTek (DMT®)XY / Z	454 / 431	314 / 271	37 / 38	58 / 59	67.2

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]			
		Powder Size (µm)	Flowability [ASTM B213 / B212]		
		Avg	78.24	Apparent Density (g/cm ³)	4.32
		Min	47.70	Flow Time for Mass (s/50g)	16.80
		Max	141.10	Flow Rate for Volume (s/cm ³)	1.45

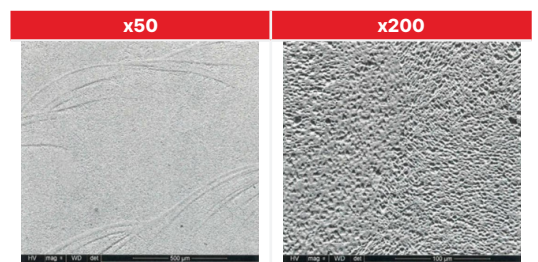
Roughness

Measuring Position	Roughness (µm)							
	M/P	Ra	Rz	Rt	M/P	Ra	Rz	Rt
	①	18.88	88.88	131.04	②	21.03	96.79	132.02

Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 8.110
	[DED] 8.136

Microstructure



Melting Point

Celsius (°C)	Fahrenheit (°F)
1690-1710	2582-2618

CoCr MP1 / UNS R31538 / DIN 2.4979



Key Features

- Excellent Biocompatibility
- Excellent Corrosion Resistance
- Excellent Wear Resistance
- Excellent Strength

Introduction of Material

- CoCr Mp1 is widely used for additive manufacturing and also called as CCM
- Co-Cr-Mo alloy is excellent in biocompatibility, mechanical properties, and wear resistance
- It is widely used in artificial joints(Hip, Knee, Ankle) and dental implants, etc
- High melting point and excellent corrosion resistance in high temperature environment
- Widely used in aircraft engine part

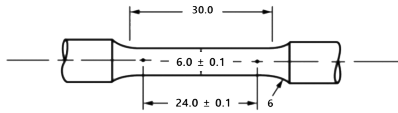
Application

- Gas Turbine
- Orthopedic Joint
- Dental Implant

Chemical Composition

UNS R31538	Co	Cr	Mo	Ni	Fe	C	Si	Mn	W	P	S	N	Al	Ti	B
Weight Percent(wt%)	Bal.	27-30	5-7	Max 0.5	Max 0.75	Max 0.35	Max 1.0	Max 1.0	Max 0.2	Max 0.02	Max 0.01	Max 0.25	Max 0.1	Max 0.1	Max 0.01

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
ASTM F75	Min. 655	Min. 450	Min. 8	Min. 8	25 / 35
Casting	655 / 758	483 / 552	8 / 15	-	25 / 34
Forging	1048 / 1170	629 / 801	7 / 9	9 / 11	-
InssTek (DMT®)XY / Z	1146 / 1136	625 / 447	12 / 25	11 / 21	35.2

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3) 4.42
		Min	Flow Time for Mass (s/50g) 17.22
		Max	Flow Rate for Volume (s/cm3) 1.52

Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	19.66	94.3	119.2
	M/P	Ra	Rz	Rt
	②	18.16	93.82	132.48

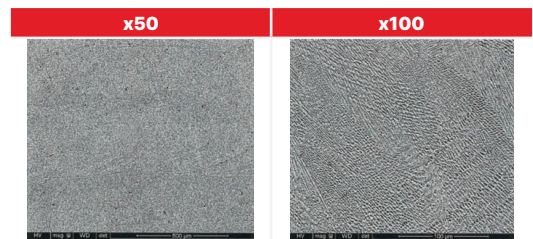
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 8.400
	[DED] 8.294

Melting Point

Celsius (°C)	Fahrenheit (°F)
1290-1360	2360-2480

Microstructure



Stellite 25 / UNS R30605 / DIN 2.4964

Key Features

- Excellent High Temperature Resistance
- Excellent Oxidation Resistance
- Acid Resistance (Maritime Environment)

Introduction of Material

- Non-magnetic Co-based superalloy and strongest Co-based alloy with excellent formability
- Maintain excellent strength up to 1177°C(2150°F)
- Maintain excellent oxidation resistance up to 1038°C(1900°F)
- Excellent resistance to high temperature oxidation and carburization
- Resistance to corrosion caused by acids such as hydrochloric acid and nitric acid and resistance to wet chlorine solutions

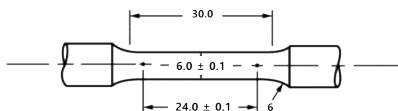
Application

- Combustor - Gas Turbine Engine
- Afterburner - Gas Turbine Engine
- Ball Bearing (High Temperature Environment)
- Spring

Chemical Composition

UNS R30605	Co	Cr	W	Ni	Fe	Mn	Si	C	Mo	Other
Weight Percent(wt%)	Bal.	19.0-21.0	15.0-16.0	9.0-11.0	Max 3.0	1.0-2.0	Max 0.40	0.05-0.15	Max 0.1	Max 0.5

Mechanical Properties



* Test Method used ASTM E8/E8M-21

Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
Casting	996	895	5	7	10-35
InssTek (DMT®)XY / Z	1030 / 958	656 / 562	27 / 37	23 / 28	27.4

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3)
		Min	Flow Time for Mass (s/50g)
		Max	Flow Rate for Volume (s/cm3)

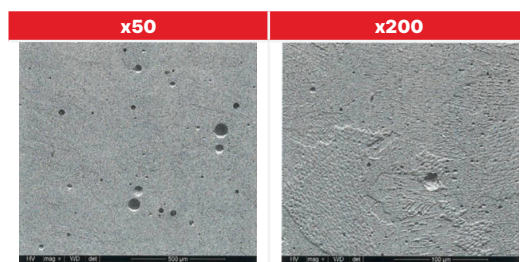
Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	12.2	73.51	101.35
	M/P	Ra	Rz	Rt
	②	11.74	54.79	81.76

Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 9.130
	[DED] 8.946

Microstructure



Melting Point

Celsius (°C)	Fahrenheit (°F)
1329-1410	2425-2570

Al-bronze / UNS C95300 / DIN 2.0937



Key Features

- Excellent Corrosion Resistance
- Excellent Sea Water Resistance

Introduction of Material

- Corrosion resistance from sea water, especially cavitation and erosion
- With its excellent weldability, widely used in maritime industry especially, ship propeller and ship blade

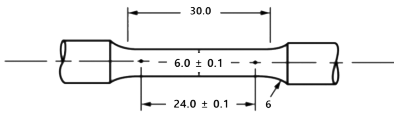
Application

- Ship Propeller
- Ship Blade

Chemical Composition

UNS C95300	Cu	Al	Fe
Weight Percent(wt%)	Bal.	9.0-11.0	0.8-1.5

Mechanical Properties



* Test Method used ASTM E8/E8M-21



Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRB)
Casting	490	180	25	25	67
InssTek (DMT®)XY / Z	628 / 598	291 / 295	26 / 21	28 / 18	77.6

Powder

SEM (x100)	SEM (x200)	Powder Spec. [Spherical for AM]	
		Powder Size (µm)	Flowability [ASTM B213 / B212]
		Avg	Apparent Density (g/cm3) 4.18
		Min	Flow Time for Mass (s/50g) 18.36
		Max	Flow Rate for Volume (s/cm3) 38.49

Roughness

Measuring Position	Roughness (µm)			
	M/P	Ra	Rz	Rt
	①	15.42	84.45	131.26
	M/P	Ra	Rz	Rt
	②	18.72	87.05	108.51

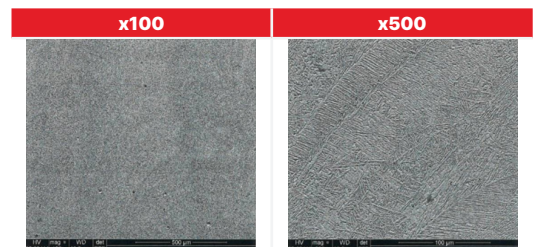
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm³)	[Typical] 7.530
	[DED] 7.448

Melting Point

Celsius (°C)	Fahrenheit (°F)
1040-1045	1904-1913

Microstructure



C-103 / UNS R04295

Key Features

- Excellent High Temperature Resistance
- Excellent Corrosion Resistance
- Excellent Creep Resistance

Introduction of Material

- Composite refractory metal alloy consisting mainly of Nb, Hf, Ti, Zr alloy elements
- Typical operating temperature is 1200~1500°C, weldability are excellent at 500°C.
- Suitable for aerospace applications, since it can withstand continuous high temperature environments
- Since material cost is high, additive manufacturing is suitable to reduce wasted material

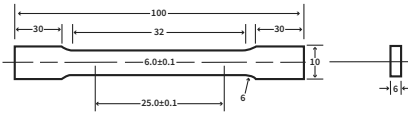
Application

- Rocket Nozzle
- Supersonic Engine Parts
- Nuclear Fusion, Reactor Component
- Medical Device
- High-speed Submarine / Trains

Chemical Composition

UNS R04295	Nb	Hf	Ti	C	O	N	H	Zr	T	Ta
Weight Percent(wt%)	Bal.	9.0-11.0	0.7-1.3	Max 0.015	Max 0.025	Max 0.01	Max 0.0015	Max 0.7	Max 0.5	Max 0.5

Mechanical Properties



* Test Method used ASTM E8/E8M-21



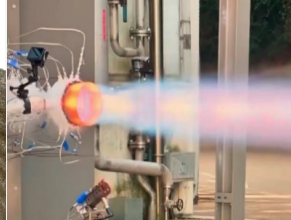
Process	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Reduction of Area (%)	Hardness (HRC)
ASTM B654	385	275	20	-	-
InssTek (DMT@)XY / Z	518	343	29	-	-

Powder

SEM (x100)		SEM (x200)		Powder Spec. [Spherical for AM]	
				Powder Size (µm)	Flowability [ASTM B213 / B212]
Avg	74.52	Apparent Density (g/cm3)	4.97		
Min	43.04	Flow Time for Mass (s/50g)	15.10		
Max	130.20	Flow Rate for Volume (s/cm3)	1.50		

Application

1ton Rocket Nozzle Extension



- Size : (Diameter) 150mm (Height) 75mm
- Thickness : 1mm
- Deposition Time : 10 hours

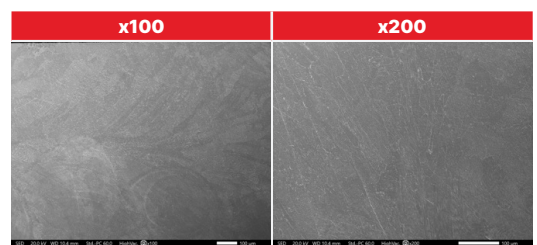
Density

Density Test	
Method	KS M 0602 [Equivalent : ASTM D792]
Density (g/cm ³)	[Typical] 8.850
	[DED] 8.778

Melting Point

Celsius (°C)	Fahrenheit (°F)
2350-2468	4260-4474

Microstructure





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