

# DMLS Materials Comparison Chart



407 Cliff Street, Ithaca, NY 14850  
 t: 607-277-7070 | f: 607-277-5511  
 sales@incodema.com  
 www.incodema.com



Material	Inconel 718	Inconel 625	Aluminum AlSi10Mg	Cobalt Chrome	Titanium Ti64	Maraging Steel 1	Stainless 15-5 PH		Stainless 17-4PH			
							Solution Heat Treatment (SHT)	H900	Stress Relief (SR) & Solution Heat Treatment (SHT)	Solution Heat Treatment (SHT) (H900)	Aging Heat Treatment (H1025)	Hot Isostatic Pressing (HIP) (H1150)
<b>Unique Properties</b>	Heat resistant alloy in fine powder form. Good rupture strength at temperatures up to 1300°F. Outstanding corrosion resistance.	Excellent fatigue and thermal fatigue properties combined with oxidation resistance	Ideal for cast parts with thin walls and complex geometries. Good dynamic properties.	Excellent mechanical properties, corrosion resistance and temperature resistance	Low specific weight and biocompatibility	Pre-alloyed ultra strength steel in fine powder form. Very good mechanical properties, easily heat treatable.	Excellent mechanical properties in the precipitation hardened state.	Machines well and has excellent welding characteristics. Adaptable to a wide variety of applications.				
<b>Applications</b>	- Turbine engine parts - Aerospace - Chemical Industry - Petroleum&Gas Industries	- Turbine engine parts - Aerospace - Exhaust&Fuel Systems - Chemical Industry - Petroleum&Gas Industries	- Parts requiring a combination of thermal properties and light weight	- Prototypes and low volume - Aerospace - Medical devices & implants	- Prototypes and low volume - Engine Components - Aerospace - Medical Implants	- Injection molds and inserts - Die Casting mold - Functional prototypes and low volume products - Parts requiring high strength and hardness	- Engineering applications - Functional Prototypes, low volume - Parts requiring high corrosion resistance, sterilizability, etc. - Parts requiring high hardness & strength	- High strength and good corrosion is required - High fatigue strength, good resistance to galling, seizing, and stress corrosion parts - Intricate parts requiring machining and/or welding				
<b>Stress Relief (SR)</b>	1950°F for 1.5 hours	2100°F +/-25°F for 2 hours +/-15 minutes in vaccum Followed by argon gas cool	570°F +/-15°F for 2 hours Followed by air cool	1922°F +/-25°F for 2 hours +/-15 minutes in vaccum	1200°F +/-25°F for 15 minutes in vaccum	-	1900°F for 1 or 2 hours	1900°F for 1 or 2 hours				
<b>Heat Treatment (HT)</b>	Optional	2150°F +/-25° for 1 hour +/- 10 minutes. Followed by 6 bar argon gas quench.	985°F +/-15°F for 5 hours +/-15 minutes Followed by water quench Aging HT: 320°F +/-15°F for 12 hours +/-15 minutes Followed by air cool	2175°F +/-25°F for 1 hour +/-15 minutes in vaccum. Followed by argon gas cooling in a protective atmosphere	1725°F +/-24°F for 45 minutes Followed by 6 bar argon quench	915°F for 6 hours (strength&hardness) 1100°F for 6 hours (ductility)	1900°F for 1 or 2 hours	1900°F for 1 or 2 hours				
<b>Hot Isostatic Pressing (HIP)</b>	Optional	Optional	Optional, but recommended	Optional	Optional	-	Optional	Optional				
<b>0.02% Yield</b>	113.7 - 164.2 ksi <sup>1</sup>	66.4 ksi <sup>2</sup>	26.1-41.6 <sup>3</sup>	92.4-160.6 <sup>4</sup>	129.2-135.7 <sup>2</sup>	147.7-280.6 ksi <sup>1</sup>	121.7 ksi	182.9 ksi	112.5 ksi	182.9 ksi	163.5 ksi	140.2 ksi
<b>Ultimate Tensile</b>	154.2 - 202.2 ksi <sup>1</sup>	132.7 ksi <sup>2</sup>	38.6-49.2 <sup>3</sup>	165.6-198.7 <sup>4</sup>	145.6-150.3 <sup>2</sup>	167.2-289.6 ksi <sup>1</sup>	163.4 ksi	207.1 ksi	154.4 ksi	206.3 ksi	170.9 ksi	152.8 ksi
<b>Elongation</b>	16.4 - 27.7% <sup>1</sup>	40.8% <sup>2</sup>	7.1-14.0 <sup>3</sup>	7.6-23.9 <sup>4</sup>	9.2-10.7 <sup>2</sup>	3.8-9.9% <sup>1</sup>	11%	13.2%	12.2 %	11.9%	12.4%	13.4%
<b>Hardness (HRC)</b>	22-42.5 <sup>1</sup>	91.9 - 93.6 <sup>2</sup>	31.0-61.1 <sup>3</sup>	31.2-41.5 <sup>4</sup>	30-32 <sup>2</sup>	34.5-41.4 <sup>1</sup>	31.6	42.5	28.2	42.7	36.5	32.7
<b>Composition</b>	Carbon= 0.08% Silicon= max 0.35% Sulfur= max 0.015% Nickel= 50.00- 55.00% Niobium= 4.75-5.50% Aluminum= 0.20-0.80% Boron= max 0.006% Manganese= max 0.35% Phosphorus(P)= max 0.015% Chromium= 17.00- 21.00% Molybdenum= 2.80-3.30% Cobalt= max 1.00% Tantalum= max 0.05% Copper= max0.30% Titanium= 0.65- 1.15% Iron= Remainder	Chromium= 22.00-23.00% Molybdenum= 8.00-10.00% Niobium= 3.15-4.15% Iron= max 5.00% Titanium= max 0.40% Aluminum= max 0.40% Cobalt= max 1.00% Carbon= max 1.00% Tantalum= max 0.05% Silicon= max 0.50% Manganese= max 0.50% Phosphorous= max 0.015% Sulfur= max 0.015% Nickel= Remainder	Silicon= 9.00-11.00% Iron= max 0.40% Copper= max 0.03% Manganese= max 0.45% Magnesium= 0.25-0.45% Nickel= 0.05% Zinc= max 0.10% Lead= max 0.05% Tin= max 0.05% Titanium= max 0.15% Other elements= 0.15% Aluminum= Balance	Chromium= 26.50-30.00% Phosphorus= max 0.02% Molybdenum= 5.00-7.00% Tungsten= max 0.20% Boron= max 0.01% Aluminum= max 0.10% Silicon= max 1.00% Manganese= max 1.00% Iron= max 0.75% Nitrogen= max 0.25% Titanium= max 0.10% Oxygen= max 0.04% Carbon= 0.08-0.15% Nickel= max 1.00% Sulfur= max 0.01% Cobalt= Balance	Aluminum= 5.50-6.75% Vanadium= 3.50-4.50% Oxygen= max 0.20% Nitrogen= max 0.05% Carbon= max 0.08% Hydrogen= max 0.015% Iron= max 0.30% Other elements= max 0.40% Titanium= Balance	Nickel= 18.00% Cobalt= max8.90% Molybdenum= max 4.92% Titanium= max 0.64% Copper= max 0.023% Nitrogen= max 0.027% Aluminum= max 0.096% Chromium= max 0.11% Carbon= max 0.011% Manganese= max 0.062% Oxygen= max 0.059% Hydrogen= 0.0003% Silicon= max 0.014% Phosphorus= max 0.008% Sulfur= max 0.003% Iron= Balance	Carbon= max 0.070% Silicon= max 1.00% Sulfur= max 0.015% Nickel= 3.50-5.50% Copper= 2.50- 4.50% Niobium +Tantalum= 0.15- 0.45% Manganese= max 1.00% Phosphorus= max 0.030% Chromium= 14.00-15.50% Molybdenum= max 0.50% Titanium + Niobium= 0.15-0.45% Iron= Balance	Carbon= max 0.07% Silicon= max 1.00% Sulfur= max 0.030% Nickel= 3.00-5.00% Copper= 3.00-5.00% Manganese= max 1.00% Phosphorus= max 0.040% Chromium= 15.00-17.50% Molybdenum= max 0.50% Titanium + Niobium= 0.15-0.45% Iron= Balance				

<sup>1</sup> Values range from DMLS as built to DMLS with Hot Isostatic Pressing (HIP) and/or Heat Treat (HT)

<sup>2</sup> Values range from DMLS with stress relief to DMLS with Hot Isostatic Pressing (HIP) and/or Heat Treat (HT)

<sup>3</sup> Values range from DMLS stress relief to DMLS with Hot Isostatic Pressing (HIP) and T6

<sup>4</sup> Values range from DMLS as built, stress relief, Hot Isostatic Pressing (HIP) and Heat Treat (HT)