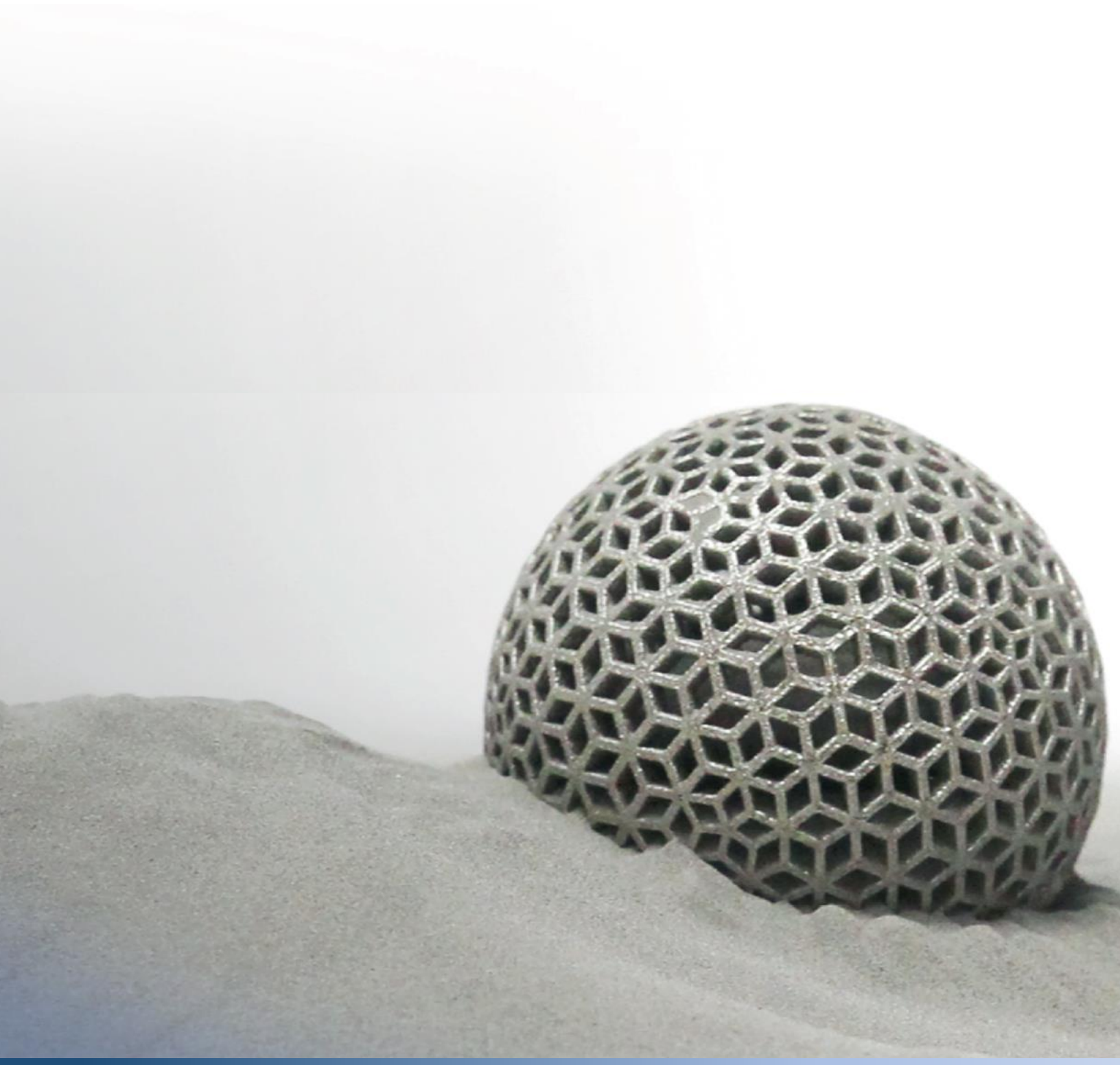
Metal Powder

Optimized for Selective Laser Melting



Material Expertise From Dental Prostheses to Turbine Blades

Customers from various sectors utilize selective laser melting machines and metal powder material from SLM Solutions to produce complex parts for a wide range of applications, each with its own strict mechanical requirements.

Aerospace

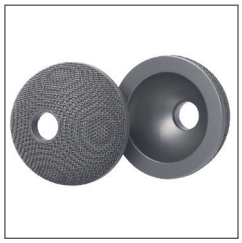
ASCO's Ti6Al4V combined-assembly gooseneck bracket flap actuation component achieved 31% weight savings and reduced production time.

Automotive

This AlSi10Mg steering knuckle from Hirschvogel Tech Solutions integrated load-adapted supports to lightweight and realized 40% material savings.

Dental Prostheses

Multiple patient-specific designs are printed during one SLM® build, enabling efficient mass customization with minimal CoCr material waste.



Medical Technology

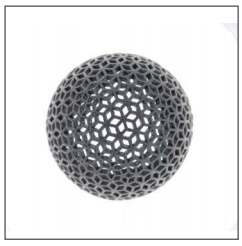
Acteabular cups printed in Grade 23 (ASTM F136) Ti6Al4V with integrated lattice structures to improve bone ingrowth and implant stability.

Energy

IN718, with its high tensile strength and corrosion resistance is utilized by Präwest for this swirler, a modified nozzle to optimize fuel distribution.

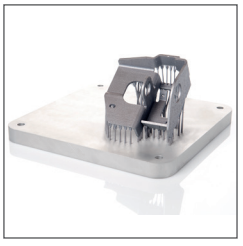
Tooling

MonaLab GmbH manufactured a single-piece aluminum extrusion tool using the freedom of design to integrate internal features to improve quality.



Research

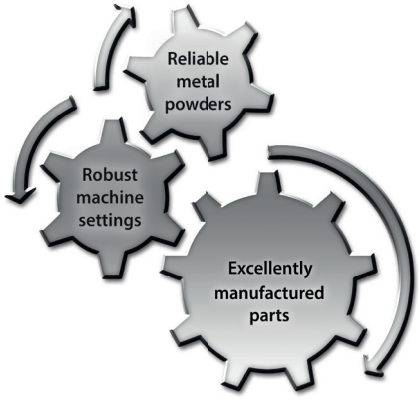
Open architecture, choice of material and partnership from SLM Solutions offer research users the flexibility to optimize process and material development.



Material Parameters

Contact us about basic parameter sets, advanced parameters targeting a specific value or our custom parameter development options.

Core Competencies



- Special metal powder selection for our selective laser melting process
- Extended certified quality assurance
- Qualified parameters for various applications
- Guarantee for processability on SLM Solutions' machines

Aluminum Alloys

AlSi10Mg

AlSi10Mg is a hardenable aluminum-alloy widely used in additive manufacturing suitable for thin-walled components with high corrosion resistance, as well as thermal and electrical conductivity properties. Featuring a nearly non-porous texture, it is ideal for highly stressed parts maintaining dynamic load capacity.

Chemical Composition (nominal) %

Element / Material[1]	Al	Si	Mg	Cu	Fe	Mn	Zn	Ti	Ni	Pb	Sn	Other	Total Others
AlSi10Mg 20-63 µm	Bal.	9.00 - 11.00	0.20 - 0.45	0.05	0.55	0.45	0.10	0.15	0.05	0.05	0.05	0.05	0.15

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	435	260
Offset yield strength	$R_{p0,2}$ [MPa]	260	145
Elongation at break	A [%]	7	10
Reduction of area	Z [%]	5	30
Young's modulus	E [GPa]	75	55
Vickers hardness	HV10	125	80
Roughness average	Ra [µm]	15	10
Mean roughness depth	Rz [µm]	65	65

Material Characteristics

- Good corrosion resistance
- High electrical conductivity
- High strength while maintaining dynamic load capacity

Typical Application Areas

- Aerospace
- Automotive
- Lightweight engineering

AlSi7Mg0.6

AlSi7Mg0.6 is suitable in applications requiring high corrosion resistance and good tolerance against strain. SLM® processed components exhibit a homogeneous, nearly non-porous texture with mechanical characteristics in the material specification range.

Chemical Composition (nominal) %

Element / Material[1]	Al	Si	Mg	Cu	Fe	Mn	Zn	Ti	Others	Total Others
AlSi7Mg0.6 20-63 µm	Bal.	6.50 - 7.50	0.45 - 0.70	0.05	0.19	0.10	0.07	0.25	0.03	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	375
Offset yield strength	$R_{p0,2}$ [MPa]	210
Elongation at break	A [%]	8
Reduction of area	Z [%]	10
Young's modulus	E [GPa]	60
Vickers hardness	HV10	110
Roughness average	Ra [µm]	5
Mean roughness depth	Rz [µm]	45

Material Characteristics

- Good electrical conductivity
- Good corrosion resistance
- Good tolerance against strain
- Excellent thermal conductivity

Typical Application Areas

- Aerospace
- Automotive
- Research & Prototyping

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

AlSi9Cu3

AlSi9Cu3 is an Al-based light metal used in applications requiring good high-temperature strength, low density and good corrosion resistance. The alloy is typically used to produce components with high strength and high dynamic loadability.

Chemical Composition (nominal) %

Material / Element[1]	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti
AlSi9Cu3 20-63 µm	Bal.	8.00 - 11.00	1.30	2.00 - 4.00	0.55	0.05 - 0.55	0.15	0.55	1.20	0.35	0.25	0.25

Mechanical Data[2]	Formula Symbol and Unit	As-built[3]
Tensile strength	R_m [MPa]	415
Offset yield strength	$R_{p0,2}$ [MPa]	235
Elongation at break	A [%]	5
Reduction in area	Z [%]	10
Young's modulus	E [GPa]	55
Vickers hardness	HV10	130
Roughness average	Ra [µm]	5
Mean roughness depth	Rz [µm]	45

Material Characteristics

- Good electrical conductivity
- Good high temperature strength
- High thermal conductivity

Typical Application Areas

- Aerospace
- Automotive
- Research & Prototyping

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

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Titanium Alloys

Ti6Al4V ELI (Grade 23)

Ti6Al4V ELI (Grade 23) is the high purity version of Ti6Al4V (Grade 5), the most widely used titanium-based alloy in the world. Ti6Al4V ELI (Grade 23) stands out because of its thermal expansion coefficient, biocompatibility, high strength at low density and excellent corrosion resistance.

Chemical Composition (nominal) %

Element / Material[1]	Ti	Al	V	Fe	C	N	O	H	Others	Total Others
Ti6Al4V (Gd 23) 20-63 µm	Bal.	5.50 - 6.50	3.50 - 4.50	0.25	0.08	0.03	0.13	0.0125	0.10	0.40

Chemistry according to ASTM F136, B348

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated	+ HIP
Tensile strength	R_m [MPa]	1280	970	1000
Offset yield strength	$R_{p0,2}$ [MPa]	1135	880	895
Elongation at break	A [%]	8	14	15
Reduction of area	Z [%]	20	50	40
Young's modulus	E [GPa]	115	120	125
Vickers hardness	HV10	370	305	315
Impact energy	[J]	15	30	20
Roughness average	Ra [µm]	10	-	-
Mean roughness depth	Rz [µm]	70	-	-

Material Characteristics

- Good corrosion resistance
- High specific strength
- High cycle fatigue strength
- High toughness

Typical Application Areas

- Orthopedic implants
- Aerospace
- Automotive
- Energy applications

TA15

TA15 is a near-α titanium alloy containing aluminum and zirconium, offering good weldability in combination with very high strength and a thermally stable microstructure, even at operating temperatures ranging from 500 °C up to 800 °C for short period of times. Applications often include heavily loaded components such as frames and other structural parts.

Chemical Composition (nominal) %

Element / Material[1]	Ti	Al	Zr	Mo	V	Si	C	Fe	O	N	H	Others	Total Others
TA15 20-63 µm	Bal.	5.50 - 7.10	1.50 - 2.50	0.50 - 2.00	0.8 - 2.50	0.15	0.08	0.25	0.15	0.05	0.015	0.10	0.30

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	1375
Offset yield strength	$R_{p0,2}$ [MPa]	1210
Elongation at break	A [%]	5
Reduction of area	Z [%]	10
Young's modulus	E [GPa]	110
Vickers hardness	HV10	385
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	100

Material Characteristics

- High specific strength
- Good weldability
- Thermal stability at high temperatures

Typical Application Areas

- Aerospace
- Automotive

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Ti (Grade 2)

Ti Grade 2 titanium-alloy is a commercially pure titanium grade with excellent biocompatibility and good mechanical properties. Ti (Grade 2) is widely used in many different applications that require excellent corrosion resistance, strength, ductility and low density.

Chemical Composition (nominal) %

Element / Material[1]	Ti	Fe	C	N	O	H	Others	Total Others
Ti Gd. 2 20-63 µm	Bal.	0.30	0.08	0.03	0.25	0.015	0.10	0.40

Chemistry according to ASTM F67, B348

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	700
Offset yield strength	$R_{p0,2}$ [MPa]	585
Elongation at break	A [%]	25
Reduction of area	Z [%]	65
Young's modulus	E [GPa]	115
Vickers hardness	HV10	220
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	80

Material Characteristics

- Excellent biocompatibility
- Excellent corrosion resistance to sea water
- Good ductility
- Moderate strength

Typical Application Areas

- Medical
- Aerospace
- Chemical / Petrochemical

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2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Nickel Alloys

HX

HX nickel is a nickel-chromium-iron-alloy important for high-temperature applications in corrosive environments for a number of industries. In a corrosive environment, this alloy can be used up to 1177 °C for static components, while creep strength is given up to 850 °C.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Co	Mo	Fe	W	C	Mn	P	S	Si
HX 10-45 µm	Bal.	20.50 - 23.00	0.50 - 2.50	8.00 - 10.00	17.00 - 20.00	0.20 - 1.00	0.05 - 0.15	1.00	0.04	0.03	1.00

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	720
Offset yield strength	$R_{p0,2}$ [MPa]	545
Elogation at break	A [%]	17
Reduction of area	Z [%]	20
Young's modulus	E [GPa]	155
Vickers hardness	HV10	240
Roughness average	Ra [µm]	10
Mean roughness depth	Rz [µm]	55

Material Characteristics

- High strength
- Good ductility
- Excellent oxidation resistance at high temperatures
- High creep strength up to 850 °C

Typical Application Areas

- Turbine engine components
- Furnace assemblies
- Energy applications

IN625

IN625 is a precipitation-hardenable nickel-chromium alloy containing significant amounts of iron, niobium, and molybdenum. It combines high corrosion resistance and strength with outstanding weldability and resistance to postweld cracking. This alloy has excellent creep-rupture strength at temperatures to 700 °C.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Mo	Nb	Fe	Co	Si	Mn	Ti	Al	C	S	P
IN625 10-45 µm	Bal.	20.00 - 23.00	8.00 - 10.00	3.15 - 4.15	5.00	1.00	0.50	0.50	0.40	0.40	0.10[3]	0.015	0.015

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated[3]
Tensile strength	R_m [MPa]	25	1020
Offset yield strength	$R_{p0,2}$ [MPa]	665	665
Elongation at break	A [%]	31	38
Reduction of area	Z [%]	45	41
Young's modulus	E [GPa]	175	185
Vickers hardness	HV10	280	290
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	40	-

Material Characteristics

- High strength
- Good ductility
- Excellent creep-rupture strength below 700 °C
- Excellent corrosion resistance

Typical Application Areas

- Aircraft engine components
- Energy applications
- Turbine parts

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

IN718

IN718 is a precipitation-hardenable nickel-chromium alloy combining good corrosion resistance at low and high temperatures up to 100+0 °C. The alloy shows outstanding weldability including resistance to postweld cracking. Furthermore, the material has excellent tensile, fatigue, creep and rupture strength at temperatures up to 700 °C.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Fe	Ta + Nb	Mo	Ti	Al	Cu	C	Si , Mn	B	Co	P, S
IN718 10-45 µm	50.00 - 55.00	17.00 - 21.00	Bal	4.75 - 5.50	2.80 - 3.30	0.65 - 1.15	0.20 - 0.80	0.30	0.08	0.35 each	0.006	1.00	0.015 each

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1025	1440
Offset yield strength	$R_{p0,2}$ [MPa]	680	1240
Elongation at break	A [%]	31	12
Reduction of area	Z [%]	35	20
Young's modulus	E [GPa]	170	200
Vickers hardness	HV10	300	465
Impact energy	[J]	75	25
Roughness average	Ra [µm]	5	-
Mean roughness depth	Rz [µm]	50	-

Material Characteristics

- High strength
- Good ductility
- Excellent mechanical properties up to 700 °C
- Excellent oxidation resistance

Typical Application Areas

- Aircraft engine components
- Rocket parts
- High-temperature environments
- Energy applications

IN939

IN939 is a highly heat- and corrosion resistant nickel based alloy. It can be used at temperatures up to 700 °C, making it ideally suited for aerospace technologies and turbine production. Nickel-based alloys exhibit good mechanical characteristic values such as high tensile- and good endurance strength.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Co	Ti	W	Al	Ta	Nb	Mn	Si	C	Zr
IN939 10-45 µm	Bal.	22.00 - 23.00	18.00 - 20.00	3.00 - 4.50	1.00 - 3.00	1.00 - 3.00	1.00 - 1.80	0.50 - 1.50	0.50	0.50	0.15	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated	+ HIP
Tensile strength	R_m [MPa]	970	1245	1350
Offset yield strength	$R_{p0,2}$ [MPa]	685	750	955
Elongation at break	A [%]	26	13	11
Reduction of area	Z [%]	35	10	10
Young's modulus	E [GPa]	165	200	195
Vickers hardness	HV10	305	-	-
Roughness average	Ra [µm]	5	-	-
Mean roughness depth	Rz [µm]	45	-	-

Material Characteristics

- High strength
- Good ductility
- Excellent high temperature mechanical properties
- Excellent corrosion resistance

Typical Application Areas

- Aerospace
- Turbine components
- Toolmaking

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Tool and Stainless Steel

316L (1.4404)

316L is a stainless steel known for good hardness with a high ductility. 316L has versatile applications where corrosion-resistance is important, such as in medical technologies, the automotive industry as well as in aerospace engineering.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Cr	Ni	Mo	Mn	Si	P	S	C	N	O
316L (1.4404) 10-45 µm	Bal.	16.00 - 18.00	10.00 - 14.00	2.00 - 3.00	2.00	1.00	0.045	0.030	0.030	0.10	0.04

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	620	575
Offset yield strength	$R_{P0,2}$ [MPa]	505	345
Elongation at break	A [%]	43	52
Reduction of area	Z [%]	65	65
Young's modulus	E [GPa]	180	180
Vickers hardness	HV10	210	170
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	70	-

Material Characteristics

- Very good corrosion resistance
- High strength under elevated temperatures
- High ductility

Typical Application Areas

- Aerospace / Automotive
- Surgical instruments
- Offshore installations
- Food industry

15-5PH (1.4545)

15-5PH is a stainless, martensitic, precipitation-hardening Cr-Ni-Cu steel that has excellent processability on SLM Solutions' additive manufacturing machines. 15-5PH is suitable for applications requiring high strength and hardness combined with moderate corrosion resistance. The alloy is the ferrite-free version of 17-4PH.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Cr	Ni	Cu	Nb + Ta	Mn	Si	P	S	C	N	O
15-5PH (1.4545) 10-45 µm	Bal.	14.00 - 15.50	3.50 - 5.50	2.50 - 4.50	0.15 - 0.45	1.00	1.00	0.04	0.03	0.07	0.10	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1225	1440
Offset yield strength	$R_{P0,2}$ [MPa]	860	1290
Elongation at break	A [%]	15	10
Reduction of area	Z [%]	50	30
Young's modulus	E [GPa]	180	195
Vickers hardness	HV10	370	455
Roughness average	Ra [µm]	25	-
Mean roughness depth	Rz [µm]	140	-

Material Characteristics

- Precipitation hardenable
- Excellent tensile strength
- Moderate corrosion resistance

Typical Application Areas

- Aerospace
- Medical
- Chemical / Petrochemical
- Paper / Metalworking industries

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

17-4PH (1.4542)

17-4PH is a martensitic precipitation-hardenable Cr-Ni-Cu-steel possessing high strength and toughness. A versatile material, it provides an outstanding combination of good corrosion resistance and mechanical properties at temperatures up to 320 °C and is suitable for heavy-strain applications, thanks to its high wear resistance.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Cr	Ni	Cu	Mn	Si	Nb + Ta	C	N	O	P	S
17-4 PH (1.4542) 10-45 µm	Bal.	15.00 - 17.50	3.00 - 5.00	3.00 - 5.00	1.00	0.07	0.15 - 0.45	0.07	0.10	0.04	0.04	0.03

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	940	1270
Offset yield strength	$R_{P0,2}$ [MPa]	500	910
Elongation at break	A [%]	25	18
Reduction of area	Z [%]	50	40
Young's modulus	E [GPa]	165	165
Vickers hardness	HV10	230	355
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	60	-

Material Characteristics

- Precipitation hardenable
- Excellent tensile strength
- Moderate corrosion resistance

Typical Application Areas

- Aerospace
- Medical
- Chemical / Petrochemical
- Paper / Metalworking industries

1.2709

Tool steels such as 1.2709 are primarily used for manufacturing tools and molds. They are characterized by a high hardness combined with a high ductility. Their specific mechanical properties allow usage in high-stressed components due to its high wear resistance.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Ni	Co	Mo	Ti	Al	Mn	Si	P	S	C
1.2709 10-45 µm	Bal.	18.00 - 19.00	8.50 - 9.50	4.70 - 5.20	0.50 - 0.80	0.05 - 0.15	0.10	0.10	0.01	0.01	0.03

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1150	2025
Offset yield strength	$R_{P0,2}$ [MPa]	940	1945
Elongation at break	A [%]	12	5
Reduction of area	Z [%]	55	20
Young's modulus	E [GPa]	175	195
Vickers hardness	HV10	350	580
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	60	-

Material Characteristics

- Martensitic hardenable
- High toughness
- High tensile strength
- Good properties up to ca. 400 °C

Typical Application Areas

- Injection molding
- Engineering parts
- Automotive
- Aerospace

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Tool and Stainless Steel

H13 (1.2344)

H13 (1.2344) is a chromium containing martensitic tool steel. This material is resistant to thermal fatigue cracking and is used in tooling applications that require exceptional strength and toughness.

Chemical Composition (nominal), %

Element / Material[1]	Fe	C	Cr	Mn	Mo	Ni+Cu	P	S	Si	V
H13 10-45 µm	Bal.	0.32 - 0.45	4.75 - 5.50	0.20 - 0.60	1.10 - 1.75	0.75	0.03	0.03	0.80 - 1.25	0.80 - 1.20

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1070	1890
Offset yield strength	$R_{p0,2}$ [MPa]	945	1605
Elongation at break	A [%]	8	3
Reduction of area	Z [%]	30	5
Young's modulus	E [GPa]	150	155
Vickers hardness	HV10	355	-
Surface roughness	Ra [µm]	5	-
Surface roughness	Rz [µm]	45	-

Material Characteristics

- High tensile strength
- Moderate corrosion resistance
- Resistant to thermal fatigue cracking

Typical Application Areas

- Injection molding
- Tooling

Invar 36®

The Fe-alloy Invar36® is a high-nickel content iron-based alloy that has a uniquely low coefficient of thermal expansion below its Curie temperature of 280 °C. Invar36® is used in components that require both high reliability and high dimensional stability over a wide range of temperatures.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Ni	Cr	Mn	Si	C	Others	Total Others
Fe-Alloy Invar36® 10-45 µm	Bal.	35.00 - 37.00	0.50	0.50	0.50	0.10	0.20	0.50

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	480	480
Offset yield strength	$R_{p0,2}$ [MPa]	385	375
Elongation at break	A [%]	33	33
Reduction of area	Z [%]	75	75
Young's modulus	E [GPa]	135	140
Vickers hardness	HV10	150	-
Surface roughness	Ra [µm]	15	-
Surface roughness	Rz [µm]	80	-

Material Characteristics

- Low coefficient of thermal expansion below its Currie temp
- Excellent mechanical properties at cryogenic temperatures
- Low tendency to fatigue at low temperatures

Typical Application Areas

- Aerospace
- Engine valves
- Precision instruments

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)
Further information and data can be found in our material data sheets.

Cobalt Alloys

CoCr28Mo6

CoCr28Mo6 is a high temperature resistant Co-Alloy with versatile applications. This corrosion resistant and biocompatible material combines high hardness with high ductility, limiting many traditional processing manufacturing options. The SLM® process provides a comparatively economic and quick option to manufacture cobalt-chromium components.

Chemical Composition (nominal), %

Element / Material[1]	Co	Cr	Mo	Mn	Si	Fe	Ni	C	Al	B	N	P	S	W	Ti
CoCr28Mo6 10-45 µm	Bal.	27.00 - 30.00	5.00 - 7.00	1.00	1.00	0.75	0.50	0.35	0.10	0.01	0.25	0.02	0.01	0.20	0.10

Chemistry according to ASTM F75

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	1215
Offset yield strength	$R_{p0,2}$ [MPa]	755
Elongation at break	A [%]	21
Reduction of area	Z [%]	15
Young's modulus	E [GPa]	205
Vickers hardness	HV10	385
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	90

Material Characteristics

- Exceptional biocompatibility
- Heat resistant
- Resistance to thermal fatigue
- High ductility

Typical Application Areas

- Orthopedic implants
- Dental prostheses
- Energy engineering
- Jet engines

SLM® MediDent

SLM® MediDent is a cobalt, chromium, molybdenum and tungsten alloy specially designed for applications in the dental industry. SLM® MediDent is used primarily for the production of biocompatible dental implants and prostheses.

Chemical Composition (nominal), %

Element / Material[1]	Co	Cr	Mo	W	Si	Fe	Mn	Ni	Pb	C	B	P	S	Be	Cd	Total Others
SLM® MediDent 10-45 µm	Bal.	22.70-26.70	4.00 - 6.00	4.40 - 6.40	2.00	0.50	0.10	0.10	0.02	0.02	0.10	0.10	0.10	0.02	0.02	0.50

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1140	1415
Offset yield strength	$R_{p0,2}$ [MPa]	655	1185
Elongation at break	A [%]	14	4
Reduction of area	Z [%]	10	5
Young's modulus	E [GPa]	170	245
Vickers hardness	HV10	375	-
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	75	-

Material Characteristics

- Biocompatible
- Corrosion resistant

Typical Application Areas

- Dental
- Medical

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Copper Alloys

CuSn10

SLM Solutions' bronze CuSn10 is a copper-tin alloy with high elongation and medium hardness. Bronze is characterized by good wear properties, resistance to atmospheric corrosion. SLM®-processed CuSn10 components exhibit a homogeneous, nearly non-porous texture with targeted mechanical characteristics.

Chemical Composition (nominal) %

Element / Material[1]	Cu	Sn	Al	Fe	Mn	Ni	P	Pb	S	Sb	Si	Zn
Bronze CuSn10 20-63 µm	Bal.	9.00 - 11.00	0.01	0.20	0.10	2.00	0.20	1.00	0.05	0.20	0.02	0.50

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	505
Offset yield strength	$R_{p0,2}$ [MPa]	380
Elongation at break	A [%]	19
Reduction of area	Z [%]	20
Young's modulus	E [GPa]	115
Vickers hardness	HV10	160
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	90

Material Characteristics

- Good mechanical properties
- Good corrosion resistance
- Cavitation resistance in sea water
- Good thermal conductivity

Typical Application Areas

- Pump housings
- Hydraulic turbines
- Instrument panels
- Diffusers and impellers

CuNi2SiCr

The low-alloyed copper-alloy CuNi2SiCr is a thermally hardenable alloy with high stiffness, even at elevated temperatures. Due to the low additives, the properties of pure copper (strength, softening temperature) can be considerably improved, while other properties (electrical and thermal conductivity, corrosion resistance) are largely retained. Typical areas of application are toolmaking, conductive contacts in electrical engineering or valves.

Chemical composition (nominal), %

Material / Element[1]	Cu	Ni	Si	Cr	Fe	Mn	Pb	Total others
CuNi2SiCr 20-63 µm	Bal.	2.00 - 3.00	0.50 - 0.80	0.20 - 0.50	0.15	0.10	0.02	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	300	645
Offset yield strength	$R_{p0,2}$ [MPa]	245	565
Elongation at break	A [%]	37	20
Reduction of area	Z [%]	80	55
Young's modulus	E [GPa]	95	110
Vickers hardness	HV10	105	220
Roughness average	Ra [µm]	20	-
Mean roughness depth	Rz [µm]	105	-

Material characteristics

- Balanced combination of electrical and thermal conductivity
- High wear resistance
- High corrosion resistance, in particular to stress corrosion cracking

Typical application areas

- Welding technology
- Electrical engineering
- Tooling

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Material Expertise From Dental Prostheses to Turbine Blades

Customers from various sectors utilize selective laser melting machines and metal powder material from SLM Solutions to produce complex parts for a wide range of applications, each with its own strict mechanical requirements.

Aerospace

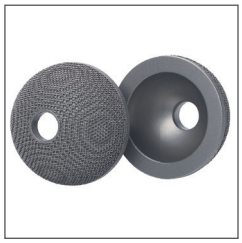
ASCO's Ti6Al4V combined-assembly gooseneck bracket flap actuation component achieved 31% weight savings and reduced production time.

Automotive

This AlSi10Mg steering knuckle from Hirschvogel Tech Solutions integrated load-adapted supports to lightweight and realized 40% material savings.

Dental Prostheses

Multiple patient-specific designs are printed during one SLM® build, enabling efficient mass customization with minimal CoCr material waste.



Medical Technology

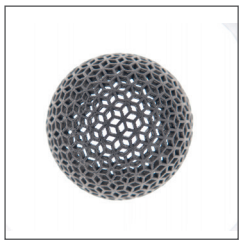
Acteabular cups printed in Grade 23 (ASTM F136) Ti6Al4V with integrated lattice structures to improve bone ingrowth and implant stability.

Energy

IN718, with its high tensile strength and corrosion resistance is utilized by Präwest for this swirler, a modified nozzle to optimize fuel distribution.

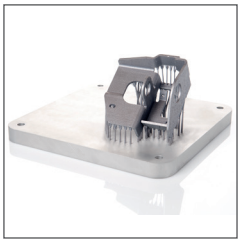
Tooling

MonaLab GmbH manufactured a single-piece aluminum extrusion tool using the freedom of design to integrate internal features to improve quality.



Research

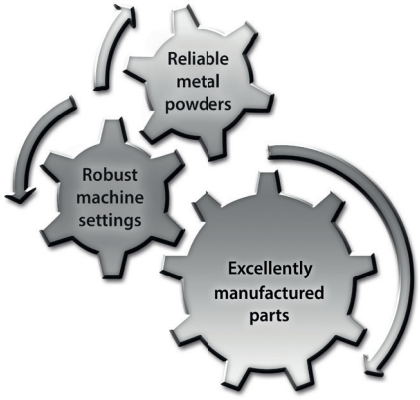
Open architecture, choice of material and partnership from SLM Solutions offer research users the flexibility to optimize process and material development.



Material Parameters

Contact us about basic parameter sets, advanced parameters targeting a specific value or our custom parameter development options.

Core Competencies



- Special metal powder selection for our selective laser melting process
- Extended certified quality assurance
- Qualified parameters for various applications
- Guarantee for processability on SLM Solutions' machines

Aluminum Alloys

AlSi10Mg

AlSi10Mg is a hardenable aluminum-alloy widely used in additive manufacturing suitable for thin-walled components with high corrosion resistance, as well as thermal and electrical conductivity properties. Featuring a nearly non-porous texture, it is ideal for highly stressed parts maintaining dynamic load capacity.

Chemical Composition (nominal) %

Element / Material[1]	Al	Si	Mg	Cu	Fe	Mn	Zn	Ti	Ni	Pb	Sn	Other	Total Others
AlSi10Mg 20-63 µm	Bal.	9.00 - 11.00	0.20 - 0.45	0.05	0.55	0.45	0.10	0.15	0.05	0.05	0.05	0.05	0.15

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	435	260
Offset yield strength	$R_{p0,2}$ [MPa]	260	145
Elongation at break	A [%]	7	10
Reduction of area	Z [%]	5	30
Young's modulus	E [GPa]	75	55
Vickers hardness	HV10	125	80
Roughness average	Ra [µm]	15	10
Mean roughness depth	Rz [µm]	65	65

Material Characteristics

- Good corrosion resistance
- High electrical conductivity
- High strength while maintaining dynamic load capacity

Typical Application Areas

- Aerospace
- Automotive
- Lightweight engineering

AlSi7Mg0.6

AlSi7Mg0.6 is suitable in applications requiring high corrosion resistance and good tolerance against strain. SLM® processed components exhibit a homogeneous, nearly non-porous texture with mechanical characteristics in the material specification range.

Chemical Composition (nominal) %

Element / Material[1]	Al	Si	Mg	Cu	Fe	Mn	Zn	Ti	Others	Total Others
AlSi7Mg0.6 20-63 µm	Bal.	6.50 - 7.50	0.45 - 0.70	0.05	0.19	0.10	0.07	0.25	0.03	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	375
Offset yield strength	$R_{p0,2}$ [MPa]	210
Elongation at break	A [%]	8
Reduction of area	Z [%]	10
Young's modulus	E [GPa]	60
Vickers hardness	HV10	110
Roughness average	Ra [µm]	5
Mean roughness depth	Rz [µm]	45

Material Characteristics

- Good electrical conductivity
- Good corrosion resistance
- Good tolerance against strain
- Excellent thermal conductivity

Typical Application Areas

- Aerospace
- Automotive
- Research & Prototyping

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

AlSi9Cu3

AlSi9Cu3 is an Al-based light metal used in applications requiring good high-temperature strength, low density and good corrosion resistance. The alloy is typically used to produce components with high strength and high dynamic loadability.

Chemical Composition (nominal) %

Material / Element[1]	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti
AlSi9Cu3 20-63 µm	Bal.	8.00 - 11.00	1.30	2.00 - 4.00	0.55	0.05 - 0.55	0.15	0.55	1.20	0.35	0.25	0.25

Mechanical Data[2]	Formula Symbol and Unit	As-built[3]
Tensile strength	R_m [MPa]	415
Offset yield strength	$R_{p0,2}$ [MPa]	235
Elongation at break	A [%]	5
Reduction in area	Z [%]	10
Young's modulus	E [GPa]	55
Vickers hardness	HV10	130
Roughness average	Ra [µm]	5
Mean roughness depth	Rz [µm]	45

Material Characteristics

- Good electrical conductivity
- Good high temperature strength
- High thermal conductivity

Typical Application Areas

- Aerospace
- Automotive
- Research & Prototyping

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Titanium Alloys

Ti6Al4V ELI (Grade 23)

Ti6Al4V ELI (Grade 23) is the high purity version of Ti6Al4V (Grade 5), the most widely used titanium-based alloy in the world. Ti6Al4V ELI (Grade 23) stands out because of its thermal expansion coefficient, biocompatibility, high strength at low density and excellent corrosion resistance.

Chemical Composition (nominal) %

Element / Material[1]	Ti	Al	V	Fe	C	N	O	H	Others	Total Others
Ti6Al4V (Gd 23) 20-63 µm	Bal.	5.50 - 6.50	3.50 - 4.50	0.25	0.08	0.03	0.13	0.0125	0.10	0.40

Chemistry according to ASTM F136, B348

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated	+ HIP
Tensile strength	R_m [MPa]	1280	970	1000
Offset yield strength	$R_{p0,2}$ [MPa]	1135	880	895
Elongation at break	A [%]	8	14	15
Reduction of area	Z [%]	20	50	40
Young's modulus	E [GPa]	115	120	125
Vickers hardness	HV10	370	305	315
Impact energy	[J]	15	30	20
Roughness average	Ra [µm]	10	-	-
Mean roughness depth	Rz [µm]	70	-	-

Material Characteristics

- Good corrosion resistance
- High specific strength
- High cycle fatigue strength
- High toughness

Typical Application Areas

- Orthopedic implants
- Aerospace
- Automotive
- Energy applications

TA15

TA15 is a near-α titanium alloy containing aluminum and zirconium, offering good weldability in combination with very high strength and a thermally stable microstructure, even at operating temperatures ranging from 500 °C up to 800 °C for short period of times. Applications often include heavily loaded components such as frames and other structural parts.

Chemical Composition (nominal) %

Element / Material[1]	Ti	Al	Zr	Mo	V	Si	C	Fe	O	N	H	Others	Total Others
TA15 20-63 µm	Bal.	5.50 - 7.10	1.50 - 2.50	0.50 - 2.00	0.8 - 2.50	0.15	0.08	0.25	0.15	0.05	0.015	0.10	0.30

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	1375
Offset yield strength	$R_{p0,2}$ [MPa]	1210
Elongation at break	A [%]	5
Reduction of area	Z [%]	10
Young's modulus	E [GPa]	110
Vickers hardness	HV10	385
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	100

Material Characteristics

- High specific strength
- Good weldability
- Thermal stability at high temperatures

Typical Application Areas

- Aerospace
- Automotive

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Ti (Grade 2)

Ti Grade 2 titanium-alloy is a commercially pure titanium grade with excellent biocompatibility and good mechanical properties. Ti (Grade 2) is widely used in many different applications that require excellent corrosion resistance, strength, ductility and low density.

Chemical Composition (nominal) %

Element / Material[1]	Ti	Fe	C	N	O	H	Others	Total Others
Ti Gd. 2 20-63 µm	Bal.	0.30	0.08	0.03	0.25	0.015	0.10	0.40

Chemistry according to ASTM F67, B348

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	700
Offset yield strength	$R_{p0,2}$ [MPa]	585
Elongation at break	A [%]	25
Reduction of area	Z [%]	65
Young's modulus	E [GPa]	115
Vickers hardness	HV10	220
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	80

Material Characteristics

- Excellent biocompatibility
- Excellent corrosion resistance to sea water
- Good ductility
- Moderate strength

Typical Application Areas

- Medical
- Aerospace
- Chemical / Petrochemical

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Nickel Alloys

HX

HX nickel is a nickel-chromium-iron-alloy important for high-temperature applications in corrosive environments for a number of industries. In a corrosive environment, this alloy can be used up to 1177 °C for static components, while creep strength is given up to 850 °C.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Co	Mo	Fe	W	C	Mn	P	S	Si
HX 10-45 µm	Bal.	20.50 - 23.00	0.50 - 2.50	8.00 - 10.00	17.00 - 20.00	0.20 - 1.00	0.05 - 0.15	1.00	0.04	0.03	1.00

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	720
Offset yield strength	$R_{p0,2}$ [MPa]	545
Elogation at break	A [%]	17
Reduction of area	Z [%]	20
Young's modulus	E [GPa]	155
Vickers hardness	HV10	240
Roughness average	Ra [µm]	10
Mean roughness depth	Rz [µm]	55

Material Characteristics

- High strength
- Good ductility
- Excellent oxidation resistance at high temperatures
- High creep strength up to 850 °C

Typical Application Areas

- Turbine engine components
- Furnace assemblies
- Energy applications

IN625

IN625 is a precipitation-hardenable nickel-chromium alloy containing significant amounts of iron, niobium, and molybdenum. It combines high corrosion resistance and strength with outstanding weldability and resistance to postweld cracking. This alloy has excellent creep-rupture strength at temperatures to 700 °C.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Mo	Nb	Fe	Co	Si	Mn	Ti	Al	C	S	P
IN625 10-45 µm	Bal.	20.00 - 23.00	8.00 - 10.00	3.15 - 4.15	5.00	1.00	0.50	0.50	0.40	0.40	0.10[3]	0.015	0.015

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated[3]
Tensile strength	R_m [MPa]	25	1020
Offset yield strength	$R_{p0,2}$ [MPa]	665	665
Elongation at break	A [%]	31	38
Reduction of area	Z [%]	45	41
Young's modulus	E [GPa]	175	185
Vickers hardness	HV10	280	290
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	40	-

Material Characteristics

- High strength
- Good ductility
- Excellent creep-rupture strength below 700 °C
- Excellent corrosion resistance

Typical Application Areas

- Aircraft engine components
- Energy applications
- Turbine parts

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

IN718

IN718 is a precipitation-hardenable nickel-chromium alloy combining good corrosion resistance at low and high temperatures up to 100+0 °C. The alloy shows outstanding weldability including resistance to postweld cracking. Furthermore, the material has excellent tensile, fatigue, creep and rupture strength at temperatures up to 700 °C.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Fe	Ta + Nb	Mo	Ti	Al	Cu	C	Si , Mn	B	Co	P, S
IN718 10-45 µm	50.00 - 55.00	17.00 - 21.00	Bal	4.75 - 5.50	2.80 - 3.30	0.65 - 1.15	0.20 - 0.80	0.30	0.08	0.35 each	0.006	1.00	0.015 each

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1025	1440
Offset yield strength	$R_{p0,2}$ [MPa]	680	1240
Elongation at break	A [%]	31	12
Reduction of area	Z [%]	35	20
Young's modulus	E [GPa]	170	200
Vickers hardness	HV10	300	465
Impact energy	[J]	75	25
Roughness average	Ra [µm]	5	-
Mean roughness depth	Rz [µm]	50	-

Material Characteristics

- High strength
- Good ductility
- Excellent mechanical properties up to 700 °C
- Excellent oxidation resistance

Typical Application Areas

- Aircraft engine components
- Rocket parts
- High-temperature environments
- Energy applications

IN939

IN939 is a highly heat- and corrosion resistant nickel based alloy. It can be used at temperatures up to 700 °C, making it ideally suited for aerospace technologies and turbine production. Nickel-based alloys exhibit good mechanical characteristic values such as high tensile- and good endurance strength.

Chemical Composition (nominal) %

Element / Material[1]	Ni	Cr	Co	Ti	W	Al	Ta	Nb	Mn	Si	C	Zr
IN939 10-45 µm	Bal.	22.00 - 23.00	18.00 - 20.00	3.00 - 4.50	1.00 - 3.00	1.00 - 3.00	1.00 - 1.80	0.50 - 1.50	0.50	0.50	0.15	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated	+ HIP
Tensile strength	R_m [MPa]	970	1245	1350
Offset yield strength	$R_{p0,2}$ [MPa]	685	750	955
Elongation at break	A [%]	26	13	11
Reduction of area	Z [%]	35	10	10
Young's modulus	E [GPa]	165	200	195
Vickers hardness	HV10	305	-	-
Roughness average	Ra [µm]	5	-	-
Mean roughness depth	Rz [µm]	45	-	-

Material Characteristics

- High strength
- Good ductility
- Excellent high temperature mechanical properties
- Excellent corrosion resistance

Typical Application Areas

- Aerospace
- Turbine components
- Toolmaking

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Tool and Stainless Steel

316L (1.4404)

316L is a stainless steel known for good hardness with a high ductility. 316L has versatile applications where corrosion-resistance is important, such as in medical technologies, the automotive industry as well as in aerospace engineering.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Cr	Ni	Mo	Mn	Si	P	S	C	N	O
316L (1.4404) 10-45 µm	Bal.	16.00 - 18.00	10.00 - 14.00	2.00 - 3.00	2.00	1.00	0.045	0.030	0.030	0.10	0.04

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	620	575
Offset yield strength	$R_{P0,2}$ [MPa]	505	345
Elongation at break	A [%]	43	52
Reduction of area	Z [%]	65	65
Young's modulus	E [GPa]	180	180
Vickers hardness	HV10	210	170
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	70	-

Material Characteristics

- Very good corrosion resistance
- High strength under elevated temperatures
- High ductility

Typical Application Areas

- Aerospace / Automotive
- Surgical instruments
- Offshore installations
- Food industry

15-5PH (1.4545)

15-5PH is a stainless, martensitic, precipitation-hardening Cr-Ni-Cu steel that has excellent processability on SLM Solutions' additive manufacturing machines. 15-5PH is suitable for applications requiring high strength and hardness combined with moderate corrosion resistance. The alloy is the ferrite-free version of 17-4PH.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Cr	Ni	Cu	Nb + Ta	Mn	Si	P	S	C	N	O
15-5PH (1.4545) 10-45 µm	Bal.	14.00 - 15.50	3.50 - 5.50	2.50 - 4.50	0.15 - 0.45	1.00	1.00	0.04	0.03	0.07	0.10	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1225	1440
Offset yield strength	$R_{P0,2}$ [MPa]	860	1290
Elongation at break	A [%]	15	10
Reduction of area	Z [%]	50	30
Young's modulus	E [GPa]	180	195
Vickers hardness	HV10	370	455
Roughness average	Ra [µm]	25	-
Mean roughness depth	Rz [µm]	140	-

Material Characteristics

- Precipitation hardenable
- Excellent tensile strength
- Moderate corrosion resistance

Typical Application Areas

- Aerospace
- Medical
- Chemical / Petrochemical
- Paper / Metalworking industries

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

17-4PH (1.4542)

17-4PH is a martensitic precipitation-hardenable Cr-Ni-Cu-steel possessing high strength and toughness. A versatile material, it provides an outstanding combination of good corrosion resistance and mechanical properties at temperatures up to 320 °C and is suitable for heavy-strain applications, thanks to its high wear resistance.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Cr	Ni	Cu	Mn	Si	Nb + Ta	C	N	O	P	S
17-4 PH (1.4542) 10-45 µm	Bal.	15.00 - 17.50	3.00 - 5.00	3.00 - 5.00	1.00	0.07	0.15 - 0.45	0.07	0.10	0.04	0.04	0.03

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	940	1270
Offset yield strength	$R_{P0,2}$ [MPa]	500	910
Elongation at break	A [%]	25	18
Reduction of area	Z [%]	50	40
Young's modulus	E [GPa]	165	165
Vickers hardness	HV10	230	355
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	60	-

Material Characteristics

- Precipitation hardenable
- Excellent tensile strength
- Moderate corrosion resistance

Typical Application Areas

- Aerospace
- Medical
- Chemical / Petrochemical
- Paper / Metalworking industries

1.2709

Tool steels such as 1.2709 are primarily used for manufacturing tools and molds. They are characterized by a high hardness combined with a high ductility. Their specific mechanical properties allow usage in high-stressed components due to its high wear resistance.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Ni	Co	Mo	Ti	Al	Mn	Si	P	S	C
1.2709 10-45 µm	Bal.	18.00 - 19.00	8.50 - 9.50	4.70 - 5.20	0.50 - 0.80	0.05 - 0.15	0.10	0.10	0.01	0.01	0.03

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1150	2025
Offset yield strength	$R_{P0,2}$ [MPa]	940	1945
Elongation at break	A [%]	12	5
Reduction of area	Z [%]	55	20
Young's modulus	E [GPa]	175	195
Vickers hardness	HV10	350	580
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	60	-

Material Characteristics

- Martensitic hardenable
- High toughness
- High tensile strength
- Good properties up to ca. 400 °C

Typical Application Areas

- Injection molding
- Engineering parts
- Automotive
- Aerospace

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Tool and Stainless Steel

H13 (1.2344)

H13 (1.2344) is a chromium containing martensitic tool steel. This material is resistant to thermal fatigue cracking and is used in tooling applications that require exceptional strength and toughness.

Chemical Composition (nominal), %

Element / Material[1]	Fe	C	Cr	Mn	Mo	Ni+Cu	P	S	Si	V
H13 10-45 µm	Bal.	0.32 - 0.45	4.75 - 5.50	0.20 - 0.60	1.10 - 1.75	0.75	0.03	0.03	0.80 - 1.25	0.80 - 1.20

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1070	1890
Offset yield strength	$R_{p0,2}$ [MPa]	945	1605
Elongation at break	A [%]	8	3
Reduction of area	Z [%]	30	5
Young's modulus	E [GPa]	150	155
Vickers hardness	HV10	355	-
Surface roughness	Ra [µm]	5	-
Surface roughness	Rz [µm]	45	-

Material Characteristics

- High tensile strength
- Moderate corrosion resistance
- Resistant to thermal fatigue cracking

Typical Application Areas

- Injection molding
- Tooling

Invar 36®

The Fe-alloy Invar36® is a high-nickel content iron-based alloy that has a uniquely low coefficient of thermal expansion below its Curie temperature of 280 °C. Invar36® is used in components that require both high reliability and high dimensional stability over a wide range of temperatures.

Chemical Composition (nominal), %

Element / Material[1]	Fe	Ni	Cr	Mn	Si	C	Others	Total Others
Fe-Alloy Invar36® 10-45 µm	Bal.	35.00 - 37.00	0.50	0.50	0.50	0.10	0.20	0.50

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	480	480
Offset yield strength	$R_{p0,2}$ [MPa]	385	375
Elongation at break	A [%]	33	33
Reduction of area	Z [%]	75	75
Young's modulus	E [GPa]	135	140
Vickers hardness	HV10	150	-
Surface roughness	Ra [µm]	15	-
Surface roughness	Rz [µm]	80	-

Material Characteristics

- Low coefficient of thermal expansion below its Currie temp
- Excellent mechanical properties at cryogenic temperatures
- Low tendency to fatigue at low temperatures

Typical Application Areas

- Aerospace
- Engine valves
- Precision instruments

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)
Further information and data can be found in our material data sheets.

Cobalt Alloys

CoCr28Mo6

CoCr28Mo6 is a high temperature resistant Co-Alloy with versatile applications. This corrosion resistant and biocompatible material combines high hardness with high ductility, limiting many traditional processing manufacturing options. The SLM® process provides a comparatively economic and quick option to manufacture cobalt-chromium components.

Chemical Composition (nominal), %

Element / Material[1]	Co	Cr	Mo	Mn	Si	Fe	Ni	C	Al	B	N	P	S	W	Ti
CoCr28Mo6 10-45 µm	Bal.	27.00 - 30.00	5.00 - 7.00	1.00	1.00	0.75	0.50	0.35	0.10	0.01	0.25	0.02	0.01	0.20	0.10

Chemistry according to ASTM F75

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	1215
Offset yield strength	$R_{p0,2}$ [MPa]	755
Elongation at break	A [%]	21
Reduction of area	Z [%]	15
Young's modulus	E [GPa]	205
Vickers hardness	HV10	385
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	90

Material Characteristics

- Exceptional biocompatibility
- Heat resistant
- Resistance to thermal fatigue
- High ductility

Typical Application Areas

- Orthopedic implants
- Dental prostheses
- Energy engineering
- Jet engines

SLM® MediDent

SLM® MediDent is a cobalt, chromium, molybdenum and tungsten alloy specially designed for applications in the dental industry. SLM® MediDent is used primarily for the production of biocompatible dental implants and prostheses.

Chemical Composition (nominal), %

Element / Material[1]	Co	Cr	Mo	W	Si	Fe	Mn	Ni	Pb	C	B	P	S	Be	Cd	Total Others
SLM® MediDent 10-45 µm	Bal.	22.70-26.70	4.00 - 6.00	4.40 - 6.40	2.00	0.50	0.10	0.10	0.02	0.02	0.10	0.10	0.10	0.02	0.02	0.50

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	1140	1415
Offset yield strength	$R_{p0,2}$ [MPa]	655	1185
Elongation at break	A [%]	14	4
Reduction of area	Z [%]	10	5
Young's modulus	E [GPa]	170	245
Vickers hardness	HV10	375	-
Roughness average	Ra [µm]	10	-
Mean roughness depth	Rz [µm]	75	-

Material Characteristics

- Biocompatible
- Corrosion resistant

Typical Application Areas

- Dental
- Medical

1 Maximum values, unless stated otherwise as a range
2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

Further information and data can be found in our material data sheets.

Copper Alloys

CuSn10

SLM Solutions' bronze CuSn10 is a copper-tin alloy with high elongation and medium hardness. Bronze is characterized by good wear properties, resistance to atmospheric corrosion. SLM®-processed CuSn10 components exhibit a homogeneous, nearly non-porous texture with targeted mechanical characteristics.

Chemical Composition (nominal) %

Element / Material[1]	Cu	Sn	Al	Fe	Mn	Ni	P	Pb	S	Sb	Si	Zn
Bronze CuSn10 20-63 µm	Bal.	9.00 - 11.00	0.01	0.20	0.10	2.00	0.20	1.00	0.05	0.20	0.02	0.50

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]
Tensile strength	R_m [MPa]	505
Offset yield strength	$R_{p0,2}$ [MPa]	380
Elongation at break	A [%]	19
Reduction of area	Z [%]	20
Young's modulus	E [GPa]	115
Vickers hardness	HV10	160
Roughness average	Ra [µm]	15
Mean roughness depth	Rz [µm]	90

Material Characteristics

- Good mechanical properties
- Good corrosion resistance
- Cavitation resistance in sea water
- Good thermal conductivity

Typical Application Areas

- Pump housings
- Hydraulic turbines
- Instrument panels
- Diffusers and impellers

CuNi2SiCr

The low-alloyed copper-alloy CuNi2SiCr is a thermally hardenable alloy with high stiffness, even at elevated temperatures. Due to the low additives, the properties of pure copper (strength, softening temperature) can be considerably improved, while other properties (electrical and thermal conductivity, corrosion resistance) are largely retained. Typical areas of application are toolmaking, conductive contacts in electrical engineering or valves.

Chemical composition (nominal), %

Material / Element[1]	Cu	Ni	Si	Cr	Fe	Mn	Pb	Total others
CuNi2SiCr 20-63 µm	Bal.	2.00 - 3.00	0.50 - 0.80	0.20 - 0.50	0.15	0.10	0.02	0.10

Mechanical Data[2]	Formula Symbol and Unit	As-Built[3]	Heat Treated
Tensile strength	R_m [MPa]	300	645
Offset yield strength	$R_{p0,2}$ [MPa]	245	565
Elongation at break	A [%]	37	20
Reduction of area	Z [%]	80	55
Young's modulus	E [GPa]	95	110
Vickers hardness	HV10	105	220
Roughness average	Ra [µm]	20	-
Mean roughness depth	Rz [µm]	105	-

Material characteristics

- Balanced combination of electrical and thermal conductivity
- High wear resistance
- High corrosion resistance, in particular to stress corrosion cracking

Typical application areas

- Welding technology
- Electrical engineering
- Tooling

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2 Process conditions and parameters according to SLM Solutions' standards
3 Rounded mean values of identified layer thicknesses and different orientations (elongations at break are not rounded)

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