Material Data Sheet

Stainless Steel 17-4PH / 1.4542 / A564[1]

General

17-4PH is a martensitic precipitation-hardenable Cr-Ni-Cu-steel possessing high strength and toughness. It provides an outstanding combination of good corrosion resistance and good mechanical properties at temperatures up to 320 °C. This versatile material is widely used in the aerospace, chemical, petrochemical, and general metalworking industries. The good mechanical characteristic values of stainless steel make it suitable for heavy-strain applications, thanks to its high wear resistance.

Material Structure

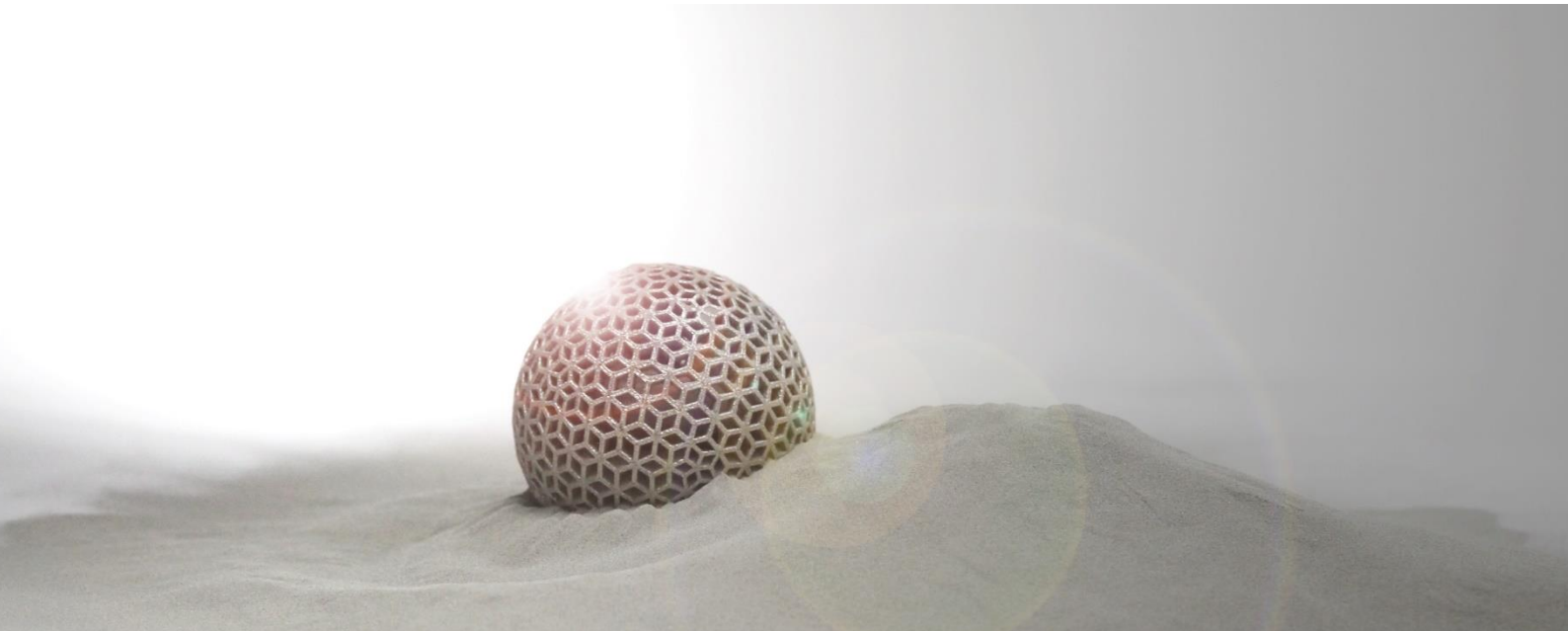
SLM®-processed steel components exhibit a homogeneous, nearly non-porous texture, with mechanical characteristic values in the range of material specifications. Through subsequent processing such as heat treatment (e.g. precipitation hardening), the components' properties can be adapted to meet specific requirements.

Chemical composition [Mass fraction in %][7]

Fe	Cr	Ni	Cu	Mn	Si	Nb + Ta	C	N	O	P	S
Balance	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	0.040	0.015

Pulvereigenschaften

Particle size[7]	10 – 45 µm	Particle shape[8]	Spherical
Mass density[2]	7.8 g/cm³	Thermal conductivity	16 W/(m·K)



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Layer thickness 30 µm [3]	As-built	Heat-treated[12]
Build-up rate[10] [cm³/h]	16.85 cm³/h	
Component density[11] [%]	≥ 99.5 %	

Tensile test[9]			M	SD	M	SD
Tensile strength	R_m [MPa]	H	987	22	1359	9
		V	931	45	1308	88
Offset yield strength	$R_{p0,2}$ [MPa]	H	517	27	1024	11
		V	506	25	1091	27
Elongation at break	A [%]	H	26	2	16	2
		V	28	2	14	6
Reduction of area	Z [%]	H	56	2	27	10
		V	56	8	26	17
Young's modulus	E [GPa]	H	171	28	154	5
		V	154	19	182	4

Hardness test[10]		M	SD	M	SD
Vickers hardness	HV10	226	2	352	22

Roughness measurement[11]			As-built		Corundum blasted		Glass-bead blasted	
			M	SD	M	SD	M	SD
Roughness average	Ra	[µm]	9	2	6	1	5	1
Mean roughness depth	Rz	[µm]	60	10	36	9	30	6

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Layer thickness 50 µm [3]	As-built	Heat-treated[12]
Build-up rate[10] [cm³/h]	16.85 cm³/h	
Component density[11] [%]	≥ 99.5 %	

Tensile test[9]			M	SD	M	SD
Tensile strength	R_m [MPa]	H	966	13	1267	23
		V	907	5	1189	16
Offset yield strength	$R_{p0,2}$ [MPa]	H	508	17	897	54
		V	511	18	866	41
Elongation at break	A [%]	H	26	1	20	1
		V	33	1	22	1
Reduction of area	Z [%]	H	62	2	47	3
		V	66	2	53	5
Young's modulus	E [GPa]	H	177	36	162	16
		V	148	3	151	5

Hardness test[10]		M	SD	M	SD
Vickers hardness	HV10	229	32	367	24

Roughness measurement[11]		As-built		Corundum blasted		Glass-bead blasted	
		M	SD	M	SD	M	SD
Roughness average	Ra [µm]	10	1	6	1	-	-
Mean roughness depth	Rz [µm]	64	7	38	3	-	-

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The properties and mechanical characteristics apply to powder that is tested and sold by SLM Solutions, and that has been processed on SLM Solutions machines using the original SLM Solutions parameters in compliance with the applicable operating instructions (including installation conditions and maintenance). The part properties are determined based on specified procedures. More details about the procedures used by SLM Solutions are available upon request.

The specifications correspond to the most recent knowledge and experience available to us at the time of publication and do not form a sufficient basis for component design on their own. Certain properties of products or parts or the suitability of products or parts for specific applications are not guaranteed. The manufacturer of the products or parts is responsible for the qualified verification of the properties and their suitability for specific applications. The manufacturer of the products or parts is responsible for protecting any third-party proprietary rights as well as existing laws and regulations.

[1] Material according to DIN EN 10088-1:2014, ASTM A564.

[2] Material density varies by ± 0,01 g/cm³ within the range of possible chemical composition variations.

[3] Material data file: 17-4PH_SLM_MBP3.0_30_CE2_400W_Stripes_V1.2

[4] Material data file: 17-4PH_SLM_MBP3.0_50_CE2_400W_Stripes_V1.1

[5] Optical density determination by light microscopy.

[6] Theoretical build-up rate for each laser = layer thickness x scan speed x track distance.

[7] With respect to powder material.

[8] According to DIN EN ISO 3252:2001.

[9] Tensile test according to DIN EN ISO 6892-1:2017 B (DIN 50125:2016 – B6x30); orientation: 0°, 90°; heat treatment: none; testing machine: Zwick 1484; load range: 200 kN; testing speed: 0,008 1/s; testing temperature: room temperature. Test samples were turned before tensile test.

[10] Hardness testing according to DIN EN ISO 6507-1:2018.

[11] Roughness measurement according to DIN EN ISO 4288:1998; λc = 2,5 mm.

[12] Heat treatment according to ASTM A564 (H900): 1. Solution annealing at 1040 °C for 30 min 2. Ageing at 480 °C for 60 min.

SLM Solutions Group AG | Estlandring 4 | 23560 Lübeck | Germany
+49 451 4060 - 3000 | info@slm-solutions.com | slm-solutions.com

SLM Solutions Group AG | 191217-17-4PH