Material Data Sheet

Ni-Alloy HX / 2.4665 / B435[1]

General

The nickel-chromium-iron-alloy HX was developed in the mid-19th-century. The mechanical-technological properties were improved continuously. Today, HX is an important alloy for high temperature and corrosive environments. Because of its resistance to corrosion and its high temperature strength HX is used for power station parts, turbine engine components or furnace parts. 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.

Material Structure

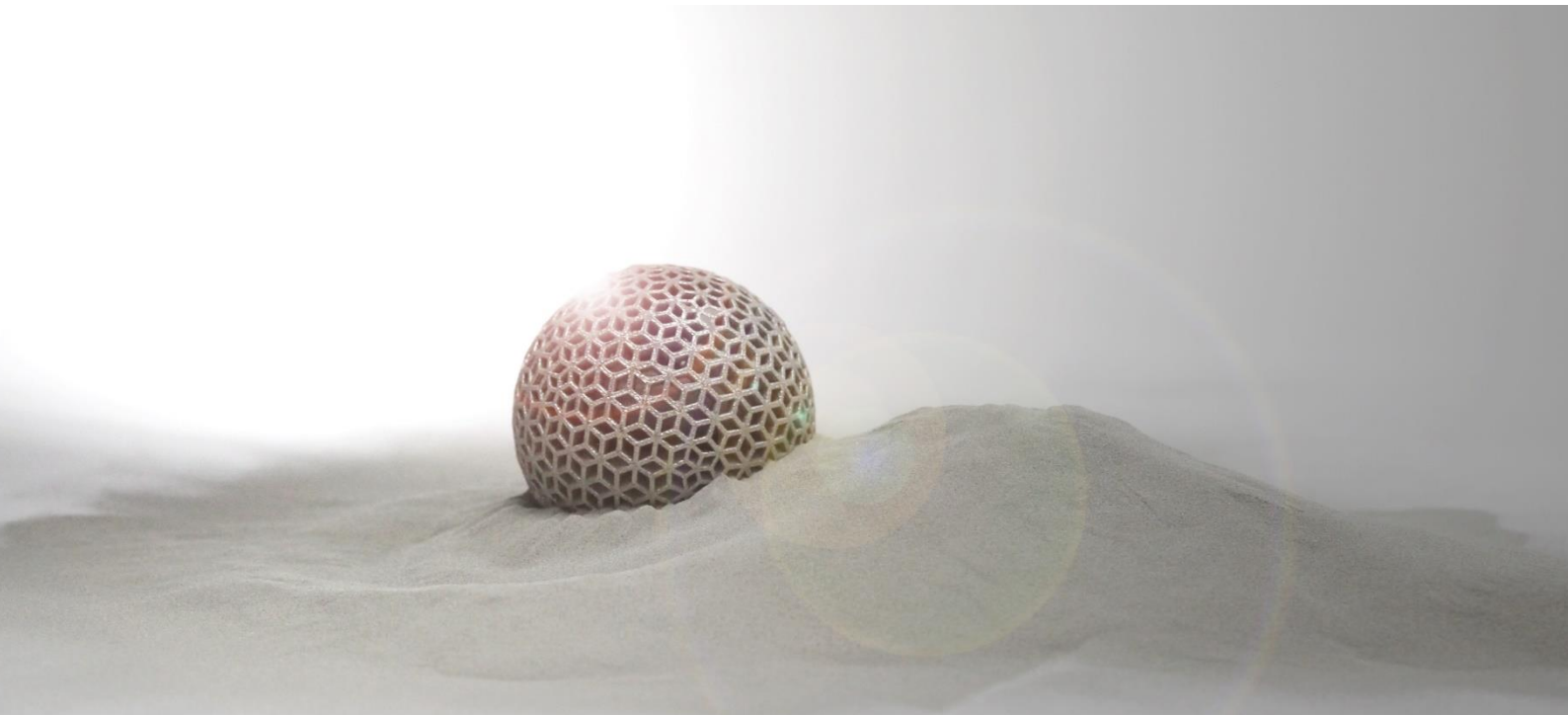
SLM®-processed nickel-based components exhibit a homogeneous, nearly non-porous texture, with mechanical characteristic values in the range of material specifications. Through subsequent processing such as heat treatment (e.g. solution annealing) or hot isostatic pressing (HIP), the components' properties can be adapted to meet specific requirements.

Chemical composition [Mass fraction in %][2]

Ni	Cr	Fe	Mo	Co	Si	W	Mn	C	P	S	O
Balance	20.00 – 23.00	17.00 – 20.00	8.00 – 10.00	0.50 – 2.50	1.00	0.20 – 1.00	1.00	0.05 – 0.15	0.04	0.03	/

Powder properties

Particle size[3]	10 – 45 µm	Particle shape[4]	Spherical
Mass density[5]	8.46 g/cm³	Thermal conductivity[6]	9.7 W/(m·K)



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Layer thickness 30 µm[3]	As-built

Build-up rate [6]	[cm³/h]	9.1 cm³/h
Component density[5]	[%]	> 99.5 %

Tensile test[9]			M	SD
Tensile strength	R_m	[MPa]	772	24
Offset yield strength	$R_{p0,2}$	[MPa]	595	28
Elongation at break	A	[%]	20	6
Reduction of area	Z	[%]	21	7
Young's modulus	E	[GPa]	162	11

Hardness test[10]		M	SD
Vickers hardness	HV10	248	4

Roughness measurement[11]			As-built	
			M	SD
Roughness average	Ra	[µm]	9	1
Mean roughness depth	Rz	[µm]	60	6

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Layer thickness 50 µm[4]	As-built

Build-up rate [6]	[cm³/h]	9.1 cm³/h
Component density[5]	[%]	> 99.5 %

Tensile test[12]			M	SD
Tensile strength	R_m	[MPa]	772	24
Offset yield strength	$R_{p0,2}$	[MPa]	595	28
Elongation at break	A	[%]	20	6
Reduction of area	Z	[%]	21	7
Young's modulus	E	[GPa]	162	11

Hardness test[13]		M	SD
Vickers hardness	HV10	248	4

Roughness measurement[17]			As-built	
			M	SD
Roughness average	Ra	[µm]	9	1
Mean roughness depth	Rz	[µm]	60	6

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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 17744:2002, ASTM B435.

[2] Material density varies within the range of possible chemical composition variations.

[3] Material data file: Inc_SLM_BP2.1_30_Stripes-US_T200_S09-02_V4101

[4] Material data file: Inc_SLM_BP2.1_50_Stripes-US_T0_S32-04_V4101

[5] Optical density determination at test specimens 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 laboratory: EWIS GmbH. 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.

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