Material data sheet

EOS MaragingSteel MS1

EOS MaragingSteel MS1 is a tool steel powder intended for processing on EOS DMLS™ systems.

This document provides information and data for parts built using EOS MaragingSteel MS1 powder (EOS art.-no. 9011-0016) on the following system specifications:

- EOS DMLS™ EOS M290 system
  - Ceramic blade (2200-3013)
  - Grid nozzle (2200-5501)
  - Nitrogen atmosphere
  - IPCM extra sieving module with 63 µm mesh recommended
- EOSYSTEM:
  - EOSPRINT v 1.5 (Build9) or higher
  - HCS v 2.5.22 or higher
- EOS Parameter set: MS1_040_FlexM290_200

Description

Parts built in EOS MaragingSteel MS1 have a chemical composition following US classification 18% Ni Maraging 300, European 1.2709 and German X3NiCoMoTi 18-9-5. This kind of steel is characterized by having very good mechanical properties, and being easily heat-treatable using a simple thermal age-hardening process to obtain excellent hardness and strength.

Parts built from EOS MaragingSteel MS1 are easily machinable after the building process and can be easily post-hardened to more than 50 HRC by age-hardening at 490 °C (914 °F) for 6 hours. In both as-built and age-hardened states the parts can be machined, spark-eroded, welded, micro shot-peened, polished and coated if required. Due to the layerwise building method, the parts have a certain anisotropy, which can be reduced or removed by appropriate heat treatment – e.g. solution treatment at 940 °C (1724 °F) for 2 hours - see Technical Data for examples.

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Technical Data

Powder properties

The chemical composition of the powder (wt-%):

Material composition

Element	Min	Max
Fe	Balance	
Ni	17.00	19.00
Co	8.50	9.50
Mo	4.50	5.20
Ti	0.60	0.80
Al	0.05	0.15
Cr	-	0.50
Cu	-	0.50
C		0.03
Mn		0.10
Si		0.10
P		0.01
S		0.01

Max. particle size

> 63µm [1]	max 0.5 wt.-%

[1] Sieve analysis according to ASTM B214.

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General process data

Layer thickness	40 µm
Volume rate [2]	4.2mm³/s (15.2cm³/h)

[2] The volume rate is a measure of build speed during laser exposure of the skin area. The total build speed depends on this volume rate and many other factors such as exposure parameters of contours, supports, up and downskin, recoating time, Home-In or LPM settings.

Physical and chemical properties of parts

Part density [3]	8.0-8.1 g/cm³
Part accuracy [4]	
Small parts	Approx. ± 50 µm
Large parts	Approx ± 0.1 %
Min. wall thickness [5]	Approx. 0.3 - 0.4 mm
Surface roughness after shot peening [6]	
	Ra 4-6.5 µm; Rz 20-50 µm

[3] Weighing in air and water according to ISO 3369.

[4] Based on users' experience of dimensional accuracy for typical geometries, e.g. ± 50 µm when parameters can be optimized for a certain class of parts or ± 0.1% when building a new kind of geometry for the first time or building larger parts. Part accuracy is subject to appropriate data preparation and postprocessing.

[5] Mechanical stability is dependent on geometry (wall height etc.) and application.

[6] Measurement according to ISO 4287. Due to the layerwise building the roughness strongly depends on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect.

Hardness in heat treated status [7]

Hardness Rockwell C [8]	50-57 HRC

[7] Heat treatment procedure: solution treatment at 940 °C (1724 °F) for 2 hours, air cooling + ageing at 490 °C for 6 hours, air cooling.

[8] Rockwell C (HRC) hardness measurement according to EN ISO 6508-1 on polished surface.

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Tensile properties at room temperature [9, 10, 11]

	Heat treated [7]	
	Horizontal	**Vertical**
Ultimate tensile strength, Rm	2080 MPa	2080 MPa
Yield strength, Rp0.2	2010 MPa	2000 MPa
Elongation at break, A	4 %	4 %

[9] Tensile testing according to. ISO 6892-1 B10, proportional test pieces, diameter of the neck area 5 mm (0.2 inch) , original gauge length 25 mm (1 inch). Results are derived from the validation data made with EOS M290 system and two powder LOTs.

[10] Solution and ageing treatments are needed in order to achieve corresponding mechanical properties. The numbers are average values determined from samples with horizontal and vertical orientation respectively.

[11] Mechanical properties depend on the thermal load of particular job layout as well as the positioning on the platform.

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Abbreviations

Min.	Minimum
Max.	Maximum
Approx.	Approximately
Wt.	Weight

The quoted values refer to the use of this material with above specified type of EOS DMLS system, EOSYSTEM software version, parameter set and operation in compliance with parameter sheet and operating instructions. Part properties are measured with specified measurement methods using defined test geometries and procedures. Further details of the test procedures used by EOS are available on request. Any deviation from these standard settings may affect the measured properties.

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