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 M400 system
- EOSYSTEM: EOSPRINT v.1.2
- EOS Parameter set MS1_050_FlexM400_1.0

Description

Parts built in EOS MaragingSteel MS1 have a chemical composition corresponding to 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 - 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	50 µm
Volume rate [2]	5.5 mm³/s (19.8 cm³/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 and Home-In settings.

Physical properties of parts

Part density [3]	8.0-8.1 g/cm3
Surface roughness as-manufactured [4]	
horizontal upskin surface	R_a 9 µm; Rz 60 µm
vertical surface	R_a 9 µm; Rz 45 µm

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

[4] 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 [5]

Hardness Rockwell C [6]	50-56 HRC

[5] Heat treatment procedure: Ageing temperature 490 °C (914 °F), 6 hours, air cooling

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

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Tensile data at room temperature [7, 8]

	As built	Heat treated [5]
Ultimate tensile strength, Rm	1200 MPa	2080±100 MPa
Yield strength, Rp0.2	1070 MPa	2030±100 MPa
Elongation at break A [9]	11 %	2 ± 1 %

[7] The numbers are average values and are determined from samples with horizontal and vertical orientation.

[8] Tensile testing according to. ISO 6892-1:2009 B10, proportional test pieces, diameter of the neck area 5 mm (0.2 inch) , original gauge length 25 mm (1 inch).

[9] Elongation values depends on the thermal load of particular job layout

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Abbreviations

min. minimum

max. maximum

wt. weight

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

The data correspond to EOS knowledge and experience at the time of publication and they are subject to change without notice as part of EOS' continuous development and improvement processes. EOS does not warrant any properties or fitness for a specific purpose, unless explicitly agreed upon. This also applies regarding any rights of protection as well as laws and regulations.

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