
Introduction of Stainless Steel Powder for Additive Manufacturing

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Metal powder for 3D-printing AMDAP™

Product Lineup

AMDAP™ series are metal powders with excellent flowability suitable for SLM 3D printers. The lineup includes not only standard steel powders, but also products with original compositions suitable for applications.

■ Lineup of AMDAP™ series and typical chemical composition(mass%)

AMDAP Series	Equivalent steel grade	C	Si	Mn	Ni	Cr	Mo	V	Other	Major applications
AMDAP™ SKD61	JIS-SKD61 AISI H13	0.38	1.0	0.45	–	5	1.2	1.0	–	Molds, Jigs
AMDAP™ HTC40	JIS SKD61 type die steel AISI H13 type die steel	0.13	0.1	0.45	–	5	1.2	0.4	–	Plastic injection molds, Die-casting molds
AMDAP™ HTC45	JIS SKD61 type die steel AISI H13 type die steel	0.23	0.1	0.45	–	5	1.2	0.4	–	Die-casting molds
AMDAP™ LTX	JIS SKD61 type die steel AISI H13 type die steel	0.25	0.1	0.45	6	5	1.2	0.4	–	Plastic injection molds, Die-casting molds
AMDAP™ SUS630	JIS SUS630 AISI 630	0.02	0.5	0.50	4	17	–	–	Cu:4 Nb:0.3	General machinery parts
AMDAP™ SUS316L	JIS SUS316L AISI 316L	0.02	0.5	0.20	13	17	2.5	–	–	General machinery parts
AMDAP™ SUS420J2	AISI 420M	0.33	0.6	0.40	–	13	–	–	–	Plastic injection molds

Particle size(μm)

-53/+25

AMDAP, HTC and LTX are trademarks or registered trademarks of Daido Steel Co., Ltd.

Chemical composition and 3D-printing parameters of AMDAP™ SUS316L

AMDAP™ SUS316L is a high-grade austenitic stainless steel that is superior to SUS304 in corrosion resistance, has good workability, and is non-magnetic. Used in relatively high-grade applications such as aerospace, medical equipment, and food safety.

Chemical composition of AMDAP™ SUS316

	Fe	C	Si	Mn	Ni	Cr	Mo	P	S	O	N
ASTMA182 (SUS316L Forging standard)	Bal.	<0.030	<1.00	<2.00	10.0 /15.0	16.0 /18.0	2.00 /3.00	<0.045	<0.030	-	<0.10
Our powder	Bal.	0.016	0.81	0.20	12.71	16.69	2.00	0.017	0.004	0.031	0.087

Powder specifications and 3D-printing conditions

3D printer		Concept Laser M2
Powder	Powder	AMDAP™ 316L
	Lot.	21N2064
	Particle size	+25/-53 μm
Atmosphere		N ₂ (O ₂ <0.1%)
Base plate temperature		120 °C
Squeegee speed		100 mm/s

3D-printing parameters

	Inside	Contour
Laser power (W)	300	150
Laser spot size (μm)	180	100
Scan speed (mm/s)	600	300
Layer thickness (μm)	50	50
Hatching distance (mm)	0.13	-
Energy density (J/mm ³)	76.9	-

Filling density and mechanical properties of AMDAP™ SUS316L

The mechanical properties of our 3D-printed powder after heat-treatment meet JIS standards for bulk materials. The filling density of SUS316 and 630 is 99.99% at an energy density of 76.9 J/mm².

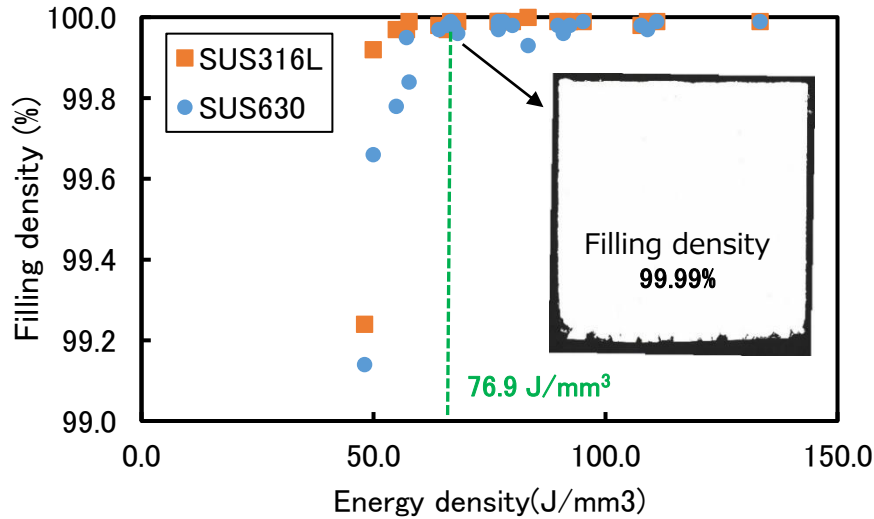


Fig. Relationship between Energy density and filling density

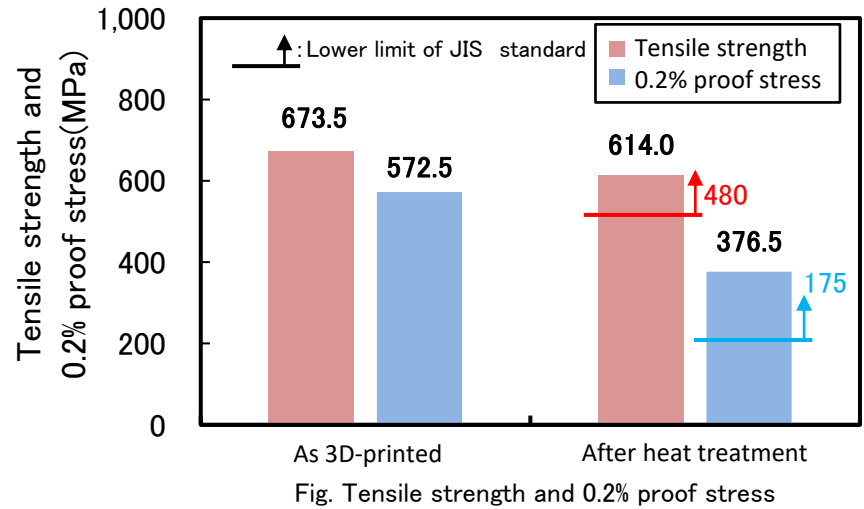


Fig. Tensile strength and 0.2% proof stress

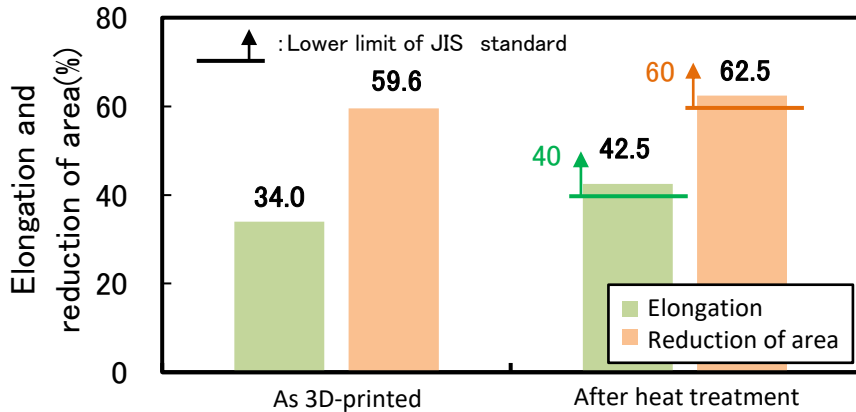


Fig. Elongation and reduction of area of 3D-printed SUS316L

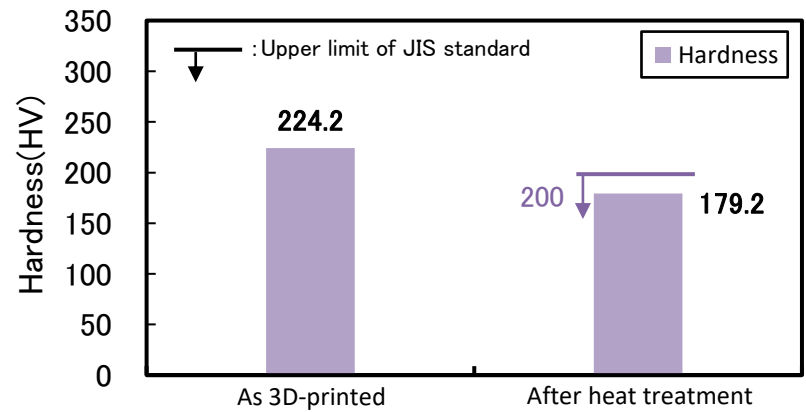


Fig. Hardness of 3D-printed SUS316L

Chemical composition and 3D-printing parameters of AMDAP™ SUS630

AMDAP™ SUS630 is a high-strength precipitation-hardened martensitic stainless steel with heat resistance and corrosion resistance equivalent to SUS304.

Chemical composition of AMDAP™ SUS630

		Fe	C	Si	Mn	Cu	Ni	Cr	Nb	P	S	O	N
Our powder		Bal.	0.027	0.27	0.24	4.17	4.29	16.2	0.27	0.014	0.003	0.050	0.056
3D-printed sample	N ₂ atmosphere	Bal.	0.023	0.26	0.21	3.94	4.33	16.1	0.27	0.013	0.003	0.050	0.055
	Ar atmosphere	Bal.	0.022	0.26	0.22	3.95	4.33	16.1	0.27	0.013	0.003	0.053	0.051
Genuine 3D printer powder※1)		Bal.	0.018	0.44	0.24	4.19	4.23	16.6	0.32	0.023	0.002	0.044	0.035
3D-printed sample	N ₂ atmosphere	Bal.	0.015	0.44	0.21	4.00	4.28	16.6	0.33	-	-	0.042	0.040
	Ar atmosphere	Bal.	0.014	0.45	0.22	3.99	4.28	16.6	0.33	-	-	0.044	0.035

Powder specifications and 3D-printing conditions

3D printer		Concept Laser M2
Powder	Powder	AMDAP™ SUS630
	Lot.	17N3061
	Particle size	+25/-53 μm
Atmosphere		N ₂ or Ar (O ₂ <0.1%)
Base plate temperature		120 °C
Squeegee speed		50 mm/s

3D-printing parameters

	Inside	Contour
Laser power (W)	300	150
Laser spot size (μm)	180	100
Scan speed (mm/s)	600	500
Layer thickness (μm)	50	50
Hatching distance (mm)	0.13	-
Energy density (J/mm ³)	76.9	-

Mechanical properties of 3D-printed AMDAP™ SUS630

Mechanical properties of our powder heat-treated products meet ASTM standards for bulk materials. The balance between strength and toughness can be adjusted by aging treatment at 480-620°C after solution treatment.

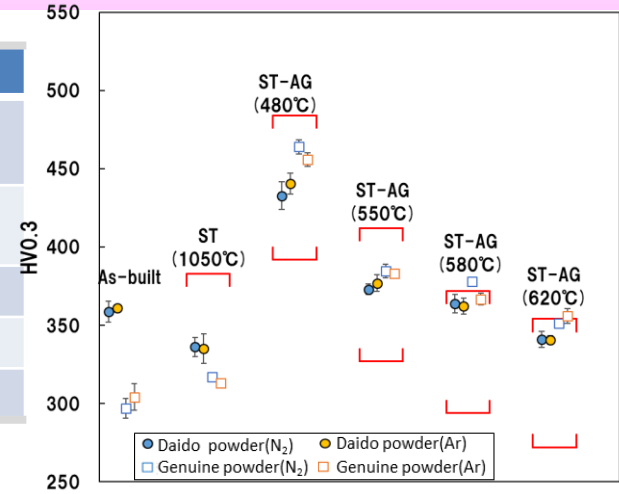
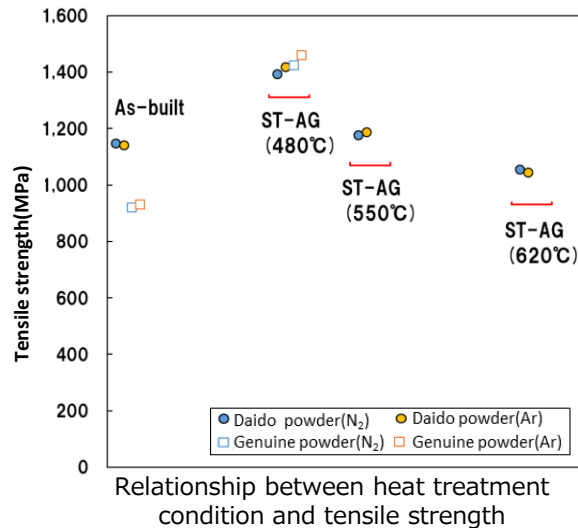
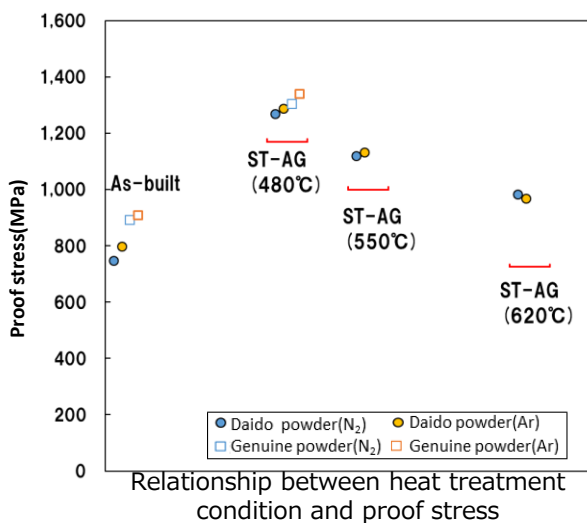
Heat treatments of AMDAP™ SUS630

Heat treatment		Heat treatment condition	remarks
Solution treatment		1050°C/0.5hr/WQ	
Aging	H900	480°C/4hr/AC	emphasis on hardness and strength
	H1025	550°C/4hr/AC	
	H1075	580°C/4hr/AC	
	H1150	620°C/4hr/AC	emphasis on toughness

Hardness measurement: Vickers hardness measurement of the center of a 12mm square Cube (n=5)

Tensile test: In accordance with JIS Z2241, square bars were heat-treated and processed into JIS 14A test pieces.

 is ASTM A693 specification range for forgings.



Relationship between heat treatment condition and hardness

