FLONO

ADDITIVE

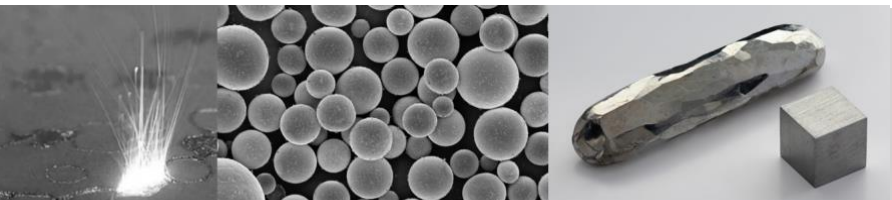
FLONO Additive existence

The aim of the company is to research and develop special applications and products related to additive manufacturing, including niche markets and highly complex applications/products and procedures based on general (316L, Ti Alloys) and specialty materials like Tantalum and Niobium. For this work, we closely collaborate with other industrial companies and universities (University of Budapest Technology and Economics). After the development work, we do serialization and manufacturing of such parts and components to serve industrial players as partners. The company can be considered as a startup in 2021.

Major industries in connection: industrial equipment manufacturing, automotive, chemical, pharmaceutical.

FLONO Additive history

2018	Idea of using additive manufacturing for industrial applications and for ready to use parts (G.VARGA)
2019 Q1-Q4	Set the focus of development areas and resulting product/application families
2019 Q3	FLONO Kft. by acquisition started to exist by two equal percentage owners, Zsombor KASZÁS and Gábor VARGA (gen. man.). Mr. Kaszás has 25+ years of experience in industrial manufacturing, trading, services related to pharma, chemical and automotive players. Mr. VARGA has 19 years experience related to pharma and chemical industrial manufacturing and processes, management, investment project management and maintenance
2020 Q1-Q2	Collecting data and application for grant (starting two individual grants: Stage 1. and Stage 2.) of research work for the Hungarian National Research and Development Office This work concentrates on the renewal of the existing repair methodology of enamelled equipment
2020. Q4	As a major milestone the application Stage 1. for the research work is granted by the Hungarian Authorities and the first stage of 1M EUR investment started
2021 Q1	Place of the FLONO Additive studio has found and located in GL Outlet Center in Törökbálint, 20 minutes from Budapest Centrum
2021 Q1-Q2	Ongoing work of tooling the FLONO Additive studio, hiring the small starting staff by back office manager and an application engineer/quality assurance specialist (Stage 1.)



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Törökbálint, H-2045
Kinizsi Pál utca 29.
additive@flono.hu
+36202624489

Major tooling of FLONO Additive Stage 1.

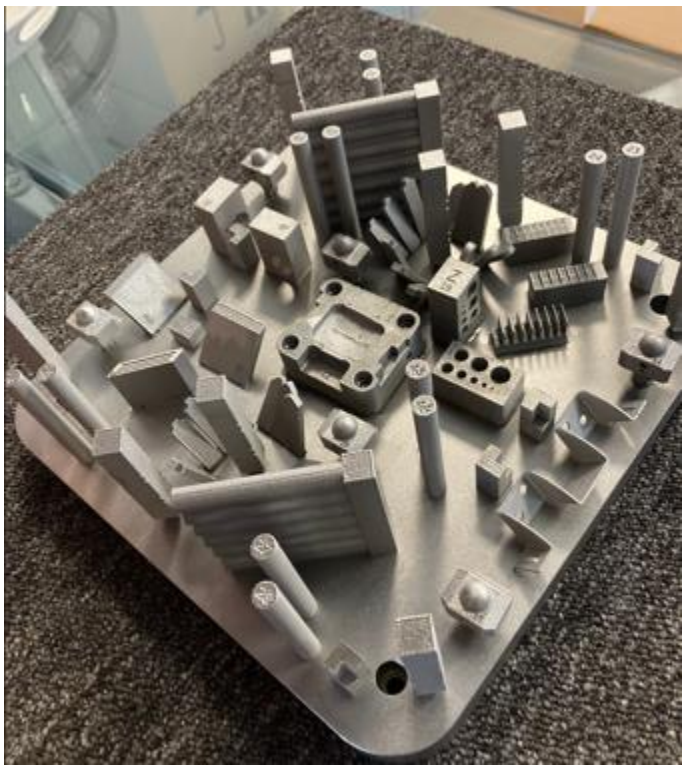
Open parameter GE M2 Cusing Direct Laser Melting System, double laser, heated platform

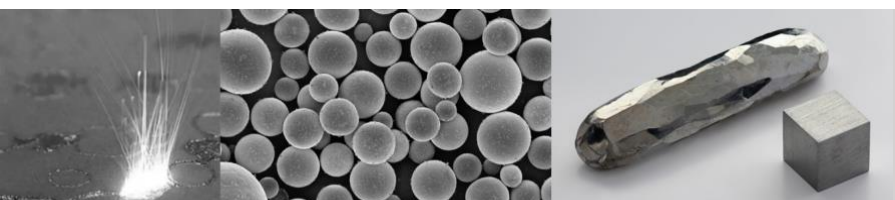
Materials available:

- Stainless Steel 316L
- Stainless Steel 17-4 PH
- Maraging Steel M300
- Aluminum AlSi10Mg
- Aluminum AlSi7Mg
- Nickel 718
- Nickel 625
- Titanium Ti6Al4V Grade 23
- Cobalt CoCrMo
- Intrinsic pure Ta (to be developed the receipt)
- Intrinsic pure Nb (to be developed the receipt)

Build data:

- Build envelope size: 250 mm x 250 mm x 350 mm
- **Effective build size: 245 mm (W) x 245 mm (D) x 345 mm (H)**
- Average geometric deviation from digital model: 7,5 um (0,0075 mm) - measured
- Maximum geometric deviation from digital model: 21 um (0,021 mm) - measured





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Creafrom HandyScan HS Black Elite handheld scanner

Size:	79*142*288 mm
Measurement speed:	1.300.000 points/sec
Scan area:	310x350 mm
Light source:	11 laser cross +1 line
Laser class:	2M (eye safe)
Resolution:	0,025 mm
Accuracy:	0,025 mm
Volumetric accuracy:	0,020 mm + 0,040 mm/m
Working distance:	300 mm
Depth of field:	250 mm
Part size range:	0,05-4 m

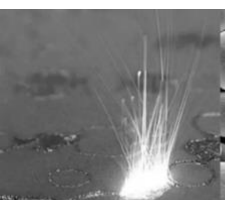
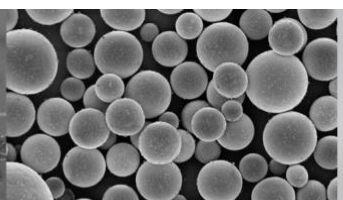
Major tooling of FLONO Additive Stage 2.

Nabertherm Furnace for stress release
up to 1200 Celsius in inert atm.
Programmed heating and cooling.

Post processing equipment for AM

Post processing DECI DUO de powdering and smoothing robot for up to Ra‹1
With further electropolishing Ra‹0,8 um or less can be achieved

Hybrid DECI Duo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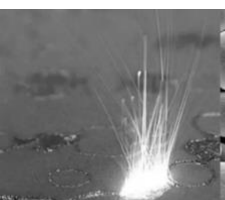
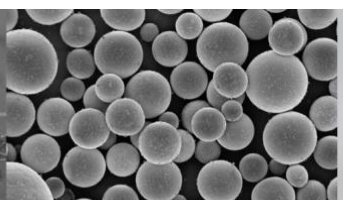
Hirtisation Module

RENA H6000
up to 500x500x350 mm parts





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GE Additive

316L

With an appropriate approval* 316L can be used for the production of acid- and corrosion resistant parts in the following fields: plant engineering, automotive industry, medical technology, jewelry and components for molds.

Data in this document represents material built with 50 µm layer thickness and in an Nitrogen atmosphere on an M2 / M2 Multilaser machine. Values listed are typical.

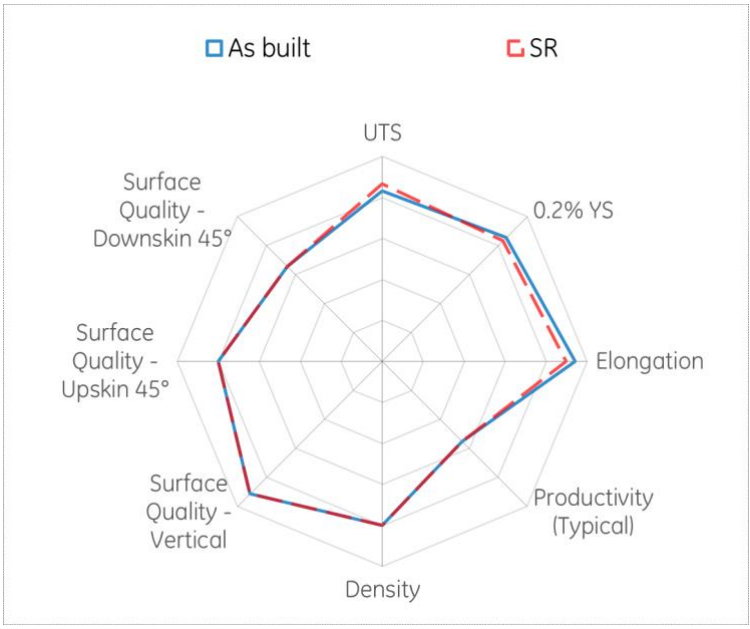
26
Fe

POWDER CHEMISTRY

Element	Indicative value (wt%)
Cr	16.5-18.0
Ni	10.0-13.0
Mo	2.0-2.5
Mn	0-2.0
Si	0-1.0
P	0-0.045
C	0-0.030
S	0-0.030
Fe	Balance

316L (powder) chemical composition et al. according to **DIN EN 10088-3**

SPIDER PLOT



MACHINE CONFIGURATION

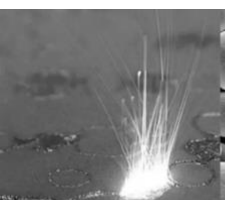
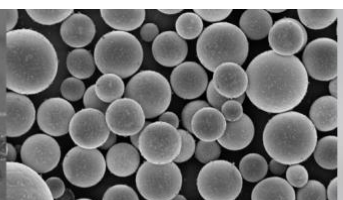
- M2 / M2 Multilaser
- Nitrogen Gas
- Rubber blade
- Layer thickness 50µm

- Build rate dual laser w/ coating *[cm³/h] : 16.5
- Max. Build rate per Laser** [cm³/h]: 21.9

*Measured
**Calculated

THERMAL STATES

1. AS BUILT
2. STRESS RELIEF (SR): 3h to 550°C, hold 6h hour at 550°C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PHYSICAL DATA AT ROOM TEMPERATURE

	Surface Roughness - Overhang (µm)		
	45°	60°	75°
Upskin	12	9	8
Downksin	17	12	10

	Surface Roughness (µm)
H	12
V	8

	Porosity (% Density)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.8	99.8	222	--	--	--
VSR	99.8	99.8	223	--	--	--

HORIZONTAL **Thermal State**	Thermal Conductivity (W/m•K)	Coeff. Of Thermal Expansion (mm/mm/K)	Thermal Diffusivity (m^2/s)	Specific Heat (J/K•kg)
As-Built	12.6	15.6×10^{-6}	3.4×10^{-6}	476
VSR	--	--	--	--

VERTICAL **Thermal State**	Thermal Conductivity (W/m•K)	Coeff. Of Thermal Expansion (mm/mm/K)	Thermal Diffusivity (m^2/s)	Specific Heat (J/K•kg)
As-Built	12.3	15.6×10^{-6}	3.4×10^{-6}	460
VSR	--	--	--	--

TENSILE DATA

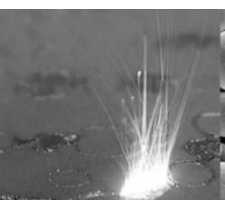
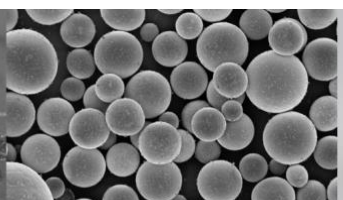
Tensile testing done in accordance with ASTM E8 and ASTM E21

Temperature: RT

	Modulus of Elasticity (GPa)		0.2% YS (MPa)		UTS (MPa)		Elongation (%)		Reduction of Area (%)	
Thermal State	H	V	H	V	H	V	H	V	H	V
As-Built	182	150	545	480	655	595	44	50	-	-
VSR	198	178	535	465	680	620	40	39	-	-

H: HORIZONTAL (XY) orientation
V: VERTICAL (Z) orientation

* All of the figures contained herein are approximate only. The figures provided are dependent on a number of factors, including but not limited to, process and machine parameters, and the approval is brand specific and/or application specific. The information provided on this material data sheet is illustrative only and cannot be relied on as binding.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