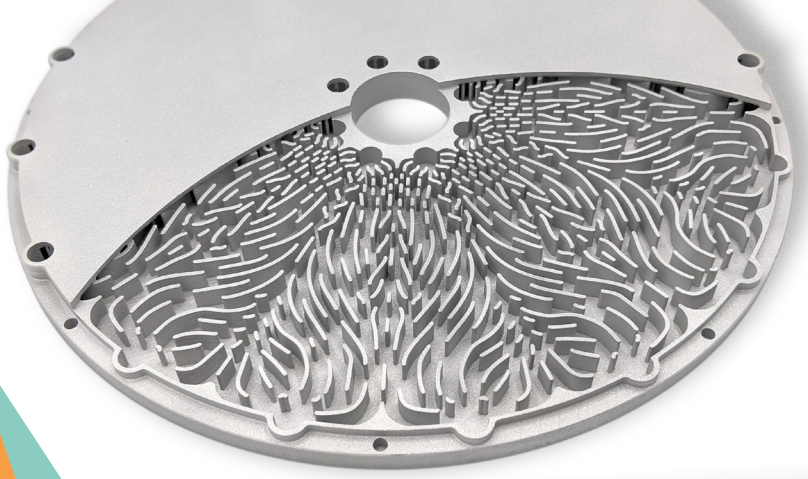
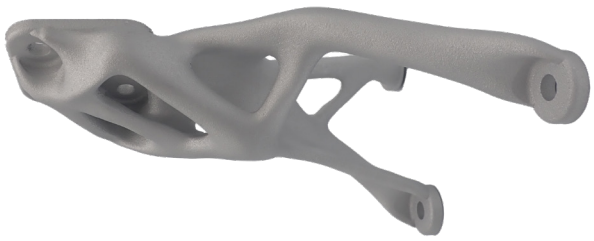




A6061-RAM2 bracket image courtesy of NASA Goddard Space Flight Center

Certified A6061-RAM2 (A)

Certified A6061-RAM2 (A) is an aluminum alloy offering improved strength, ductility, and as-built surface finish compared to traditional casting alloys such as AlSi10Mg in laser powder bed fusion (PBF-LB).

3D Systems offers application development and part production using the integrated additive manufacturing (AM) workflow software, 3DXpert®, the DMP Flex / Factory 350 and DMP Flex 350 Triple metal printer*. 3D Systems' A6061-RAM2 parameters were developed, tested, and optimized on real applications in our AS9100/ISO9001 part production facilities, which have the unique distinction of printing more than 1,000,000 challenging metal production parts in various materials, year over year. The properties listed below provide high confidence to the user in terms of job-to-job and machine-to-machine repeatability.

For companies looking to develop new applications and processes with A6061-RAM2 please contact the 3D Systems Application Innovation Group (AIG).

Material Description

Elementum 3D's reactive additive manufacturing (RAM) process inoculates solidification and protects alloys against hot tearing and produces equiaxed fine-grained microstructure with exceptional properties. The RAM process takes advantage of chemical reactions in the meltpool to form dispersion-strengthened metal matrix composite (MMC) aluminum alloys.

A6061-RAM2 is a scandium-free aluminum alloy with chemical composition optimized for laser powder bed fusion. This general-purpose AM aluminum alloy results in properties comparable to wrought 6061-T6 with excellent strength-to-weight ratio, ductility, corrosion resistance, and electrical conductivity. On the DMP Flex 350, A6061-RAM2 parts exhibit better as-built surface finish and anodization capability than AlSi10Mg.

With proven applications in aerospace, semiconductor, and motorsports industries, A6061-RAM2 is suitable for passive radio frequency, thermal management, fluid flow, and lightweight structural components.

Mechanical Properties

DMP FLEX / FACTORY 350 [1,2,3,4]	TEST METHOD	LT30		LT60	
		METRIC	U.S.	METRIC	U.S.
Ultimate tensile strength (MPa | ksi)	ASTM E8	344	50	333	48
Yield strength Rp0.2% (MPa | ksi)		316	46	306	44
Plastic elongation (%)		15		15	

DMP FLEX 350 TRIPLE [2,5]	TEST METHOD	METRIC	U.S.
Ultimate tensile strength (MPa | ksi) Horizontal direction - XY Vertical direction - Z	ASTM E8	 290 ± 5 290 ± 5	 42 ± 1 42 ± 1
Yield strength Rp0.2% (MPa | ksi) Horizontal direction - XY Vertical direction - Z		 230 ± 25 210 ± 5	 33 ± 4 30 ± 1
Plastic elongation (%) Horizontal direction - XY Vertical direction - Z		 20 20	

* Also applicable for ProX® DMP 320, former 3D Systems printer

[1] Modified T6 Heat Treatment.

[2] Tested using round tensile test specimen type 4.

[3] Typical values, averaged of vertical and horizontal tensile coupons.

[4] Parts manufactured with standard parameters and protocols on DMP Flex 350, Config B using Layer Thickness (LT) 30 and 60 µm. May deviate depending on specific part geometry.

[5] Parts manufactured with standard parameters and protocols on DMP Flex 350 Triple, using LT60 µm, not heat treated. May deviate depending on specific part geometry.

Physical Properties

MEASUREMENT	TEST METHOD	METRIC	U.S.
Electrical conductivity[4,6] (S/µm)	ASTM B193 at 20°C / 68°F	20	
Thermal conductivity[1] (w/(m-k))	Supplier test data	144	

Printed Part Properties

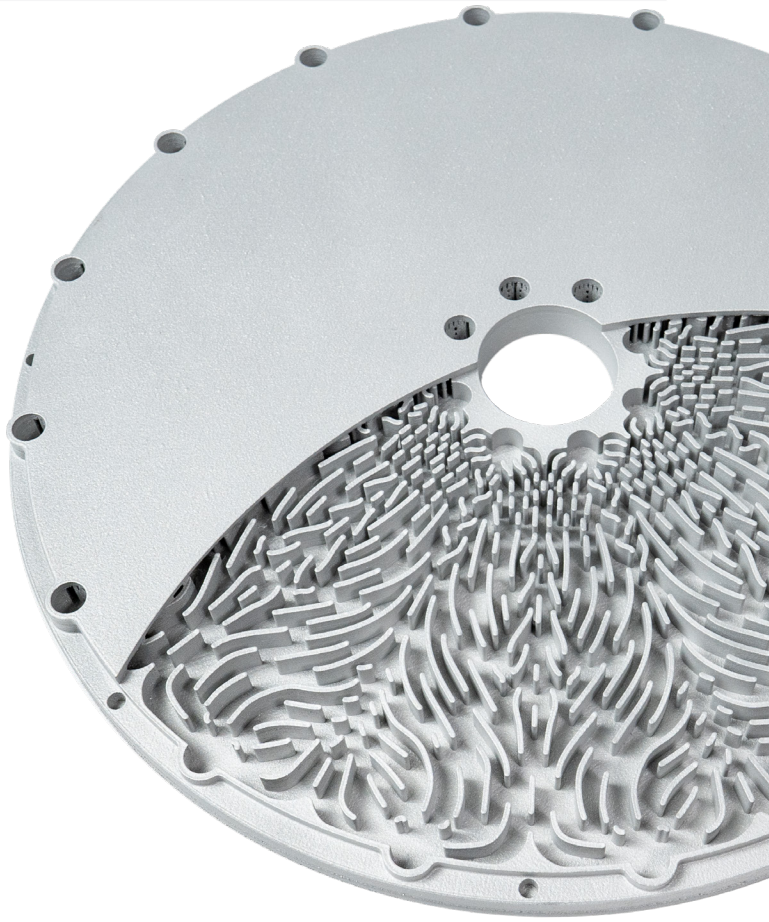
DENSITY[4,5]	TEST METHOD	METRIC	U.S.
Relative density (%)	Archimedes + Optical Evaluation	> 99.6	

SURFACE ROUGHNESS[4]	TEST METHOD	METRIC	U.S.
Vertical side surface (µm | µin) Layer thickness 30 µm Layer thickness 60 µm	ISO 25178	 8 10	 315 394

[6] Typical values, measured on vertical LT30 and LT60 samples in T6 condition.

Typical Applications

- Lightweight structural parts for aerospace and automotive
- Passive radio frequency (RF) parts for satellites
- Advanced thermal management in semiconductor capital equipment
- Parts which require anodization for corrosion resistance



Application Focus: Semiconductor Wafer Table

COMPLEX CHANNEL DESIGN
Excellent as-built surface finish enables high quality internal channels not accessible to finish machining

THIN WALLS
Wall thicknesses as low as 0.3 mm

ORGANIC SHAPES
Reduce turbulence and pressure drops inside the cooling system

PART COUNT REDUCTION AND IMPROVED LEAK-TIGHTNESS
Remove points of failure; simplify supply chain

3D SYSTEMS®
www.3dsystems.com

To confirm the suitability of this material for your specific application, please contact the 3D Systems Application Innovation Group (AIG): https://www.3dsystems.com/consulting/application-innovation-group

ELEMENTUM®

A6061-RAM2 powder can be purchased directly from Elementum 3D: https://www.elementum3d.com/contact/