A1000-RAM10™

(High Temperature Performance)

Product

A1000-RAM10 is also one of Elementum 3D's metal-matrix composite (MMC) products, which provides the added benefit of combining the ductility, conductivity, and toughness of metals with the strength, hardness, stiffness, and wear resistance of ceramic reinforcing phases. Additionally, it requires no post process heat treatment and is economically priced for small and large production runs. A1000-RAM10 is an all-purpose material and is well suited for aerospace, automotive, and military applications.

Properties

Nominal Composition: A1000 with 10% RAM Additives

Theoretical maximum density: 2.89 g/cm^3

Printed relative density: >99.8%

Deposition rate[1]: 1.51 in^3/hr (6.8 mm^3/s)

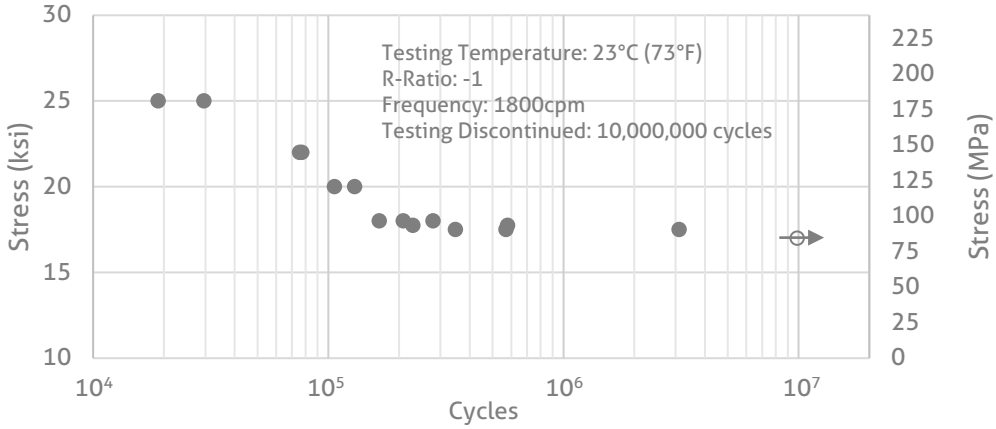
Ultimate Tensile Strength (ksi/MPa)[2]	0.2% Offset Yield Strength (ksi/MPa)[2]	Elongation (%)[2]	Hardness (HRB)[3]	Young's Modulus (Msi/GPa)[4]	CTE (ppm /°C)[5]	Thermal Conductivity (W/m·K)[6]	Wear Volume Loss (in^3/mm^3)[7]*
46 ± 2.0 / 320 ± 14	37 ± 0.5 / 260 ± 3	11 ± 1.0	45 ± 2.0	13.7 ± 0.2 / 95 ± 1.4	19	112	5.1x10^{-3} / 84

***Comparison:** [8]17-4 Stainless Steel 300mm^3, [9]A380 Cast Aluminum 304 mm^3 (Note: Lower volume loss is better)

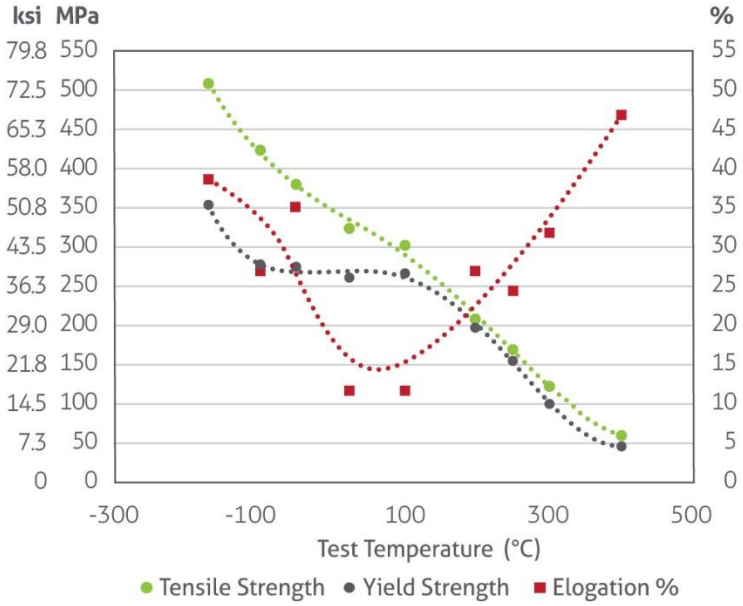
Surface roughness as-built[10]**:**

Angle	Upskin		Downskin	
Deg. °	Ra µm	Ra µin	Ra µm	Ra µin
0 (top)	4.7±0.4	187±15	NA	NA
40	5.5±1.1	215±46	15.9±3.1	624±123
45	4.1±0.3	162±13	8.5±2.3	333±90
50	3.8±0.9	151±35	7.9±1.8	309±72
90 (vertical)	3.0±0.8	120±33	NA	NA

Fatigue[11]:



Tensile properties at temperature[12]:



[1]Deposition rate calculation is for comparison purposes on an EOS M290 and does not include recoating time, laser migration time, contour exposures, etc., [2]ASTM E8, [3]ASTM E18, [4]ASTM E494-20 (ultrasonic velocity), [5]ASTM E228, [6]ASTM E1461, [7]ASTM G65 Procedure E, [8]Suthar et al. (2015). GE- International Journal of Engineering Research, 3(7), [9]Lall and Williamson. Wear Resistance and Mechanical Properties of Selected PM Aluminum Alloys and Composites, Metal Powder Products Company, [10]Surface roughness determined by stylus profilometry, [11]ASTM E466, [12]ASTM E21.

All stated values are approximate values. All details given above are our current knowledge and experience, and are dependent on the equipment, parameters, and operating conditions. The data provided in this document is subject to change and only intended as general information on a material set that is continually improving and developing. The data does not provide a sufficient basis for engineering parts. All samples were produced on an EOS M290. All tensile tests were performed at third party certified test labs such as Westmoreland Mechanical Testing & Research and Product Evaluations Systems.

Please contact us at sales@elementum3d.com for additional information.