



## ▶ A2024-RAM5™ (High Strength Aluminum)

### Product Information

Elementum 3D's AL2024-RAM5% Aluminum Metal-Matrix Composites (MMC) combine the ductility and toughness of metals with the strength, hardness, stiffness, and wear resistance of ceramic reinforcing phases. Aluminum MMCs are of particular interest to aerospace, automotive, and military applications that require high specific strength, extreme wear resistance, thermal conductivity and good retention of strength at temperature.

### Physical and Chemical Properties

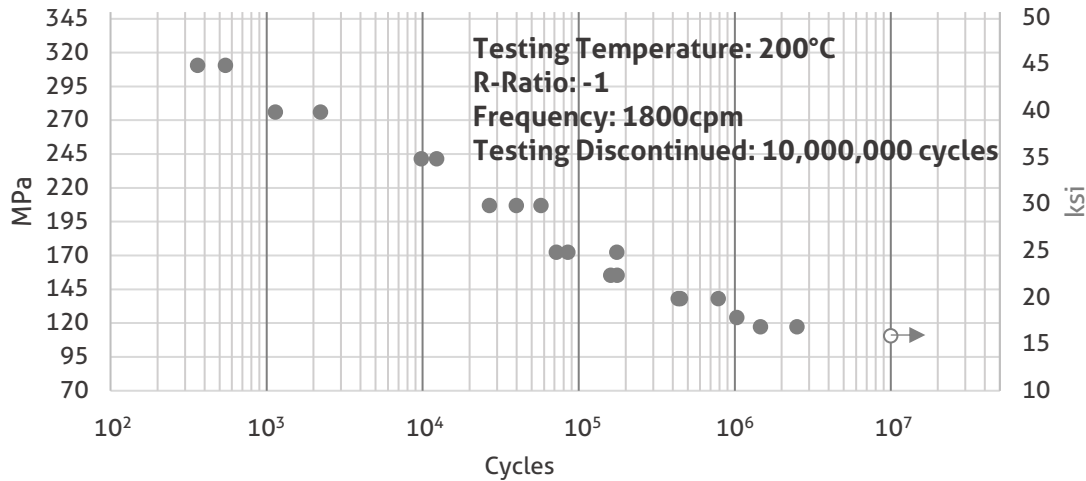
<b>Material composition:</b> Proprietary A2024 w/5% ceramic (E3D-T6 Condition)	<b>Ultimate tensile strength<sup>[1]</sup>:</b> 74 ± 2 ksi (511 MPa)
<b>Theoretical maximum density:</b> 2.86 g/cm <sup>3</sup>	<b>Yield strength<sup>[1]</sup>:</b> 65 ± 2 ksi (449 MPa)
<b>Printed relative density:</b> > 99.8%	<b>Elongation<sup>[1]</sup>:</b> 4 ± 2 %
<b>Deposition rate<sup>[4]</sup>:</b> 1.6 in <sup>3</sup> /hr (7.1 mm <sup>3</sup> /s)	<b>Modulus of elasticity<sup>[3]</sup>:</b> 12.6 ± 0.2 Msi (87 GPa)
<b>Hardness<sup>[2]</sup>:</b> 85 ± 2 HRB	

### Surface roughness as built<sup>[5]</sup>:

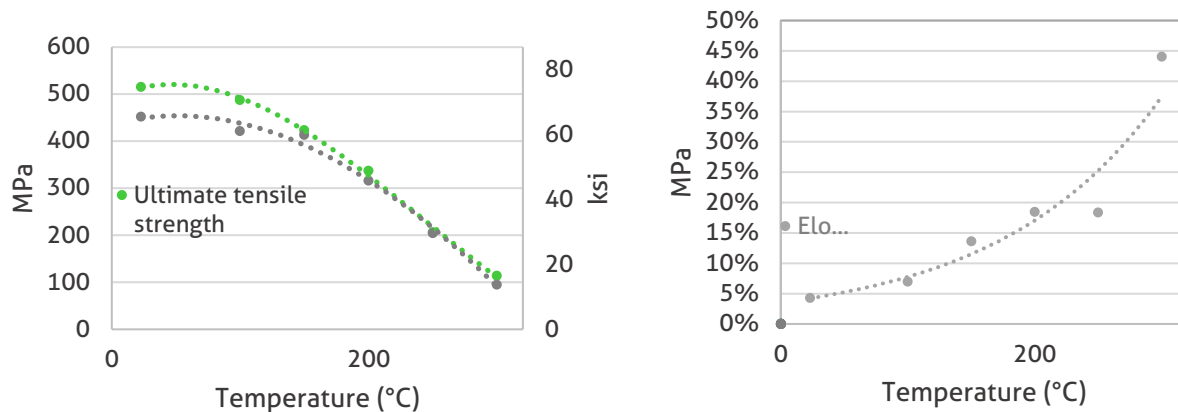
Angle Deg. °	Upskin		Downskin	
	Ra μm	Ra μin	Ra μm	Ra μin
0 (top)	3.83±.93	151±37	NA	NA
40	6.06±0.31	238±12	16.87±1.05	664±41
45	6.14±0.61	242±26	15.15±2.53	596±100
50	5.69±1.28	224±50	12.54±1.73	494±68
90 (vertical)	4.45±0.78	175±31	NA	NA



### Fatigue (200°C)<sup>[6]</sup>:



### Elevated temperature tensile<sup>[7]</sup>:



<sup>[1]</sup>ASTM E8, <sup>[2]</sup>ASTM E18, <sup>[3]</sup>ASTM E494-15 (ultrasonic velocity), <sup>[4]</sup>Deposition rate calculation is for comparison purposes on an EOS M290 and does not include recoating time, laser migration time, contour exposures, etc., <sup>[5]</sup>Surface roughness determined by stylus profilometry, <sup>[6]</sup>ASTM E21, <sup>[7]</sup>ASTM E466, <sup>[7]</sup> ASTM E466, <sup>[8]</sup>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.

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