

## 6092/SiC/25p ALUMINUM MMC

**6092/SiC/25p** Aluminum Metal-Matrix-Composite (Al MMC) is an emerging material for helicopter gearbox bearing liners. Its combination of enhanced strength and Titanium-equivalent stiffness, along with high hardness and moderately low CTE cannot be matched by monolithic aluminum alloys.

TYPICAL AND MINIMUM MECHANICAL PROPERTIES FOR BEARING LINER STOCK

6092/SiC/25p-T6 Density= 2.84 g/cm <sup>3</sup> (0.1025 lb/in <sup>3</sup> )		F, ty		F, tu		elong. %
		MPa	ksi	MPa	ksi	
Die Forging, 250mm (10in), Typical	(L)	430	62	495	72	4
Seamless Tube Extrusion, (11in), Typical	(L)	391	57	477	69	4
Sheet, 2.5mm (0.100in), Typical	(L, LT)	427	62	488	71	4
Minimum Properties	(L)	345	50	414	60	3

**Notes:**

- 1) Young's Modulus is typically 112 GPa (16.2 msi).
- 2) Coefficient-of-Thermal-Expansion (CTE) is typically 15.3 ppm/°C (8.5 ppm/°F).
- 3) Typical Rockwell B scale hardness is 83-85.

Data for forgings and extrusions is representative for 25mm (1 in) maximum section thickness during heat treatment. Mechanical properties will be dependent on the Al MMC material system, product form, geometry and heat treatment method.

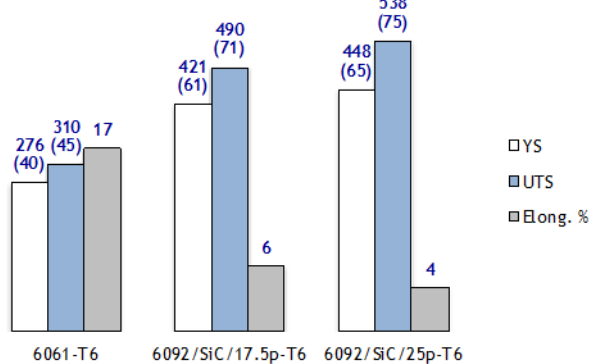
**6092/SiC/25p** is a powder metallurgy Al MMC comprised of AA6092 aluminum and 25 Vol% Silicon Carbide particles. It is available in vacuum-hot-pressed billet, extruded, forged and sheet product forms.

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# ALUMINUM METAL-MATRIX-COMPOSITES: MORE THAN ALUMINUM

**THE EXTREMELY LOW CTE OF THE SiC PARTICLES STRAINS THE ATOMIC LATTICE OF THE ALUMINUM MATRIX** resulting in a dramatic increase in dislocation density. The combination of solid-state MMC processing and dislocation formation also results in a super-fine, coherent field of precipitates in the matrix. Ultimately, both the reinforcement and the precipitates limit the mobility of these dislocations leading to enhanced yield and ultimate tensile strength in the Al MMC. Further, it is important to note that there is a direct relationship between SiC content and Al MMC strength, as shown in the measured properties for extruded bar stock.

6092 Alloy Al MMC Strength, MPa (ksi)



**6092 ALLOY MMC'S POSSESS ENHANCED WEAR PROPERTIES COMPARED WITH CONVENTIONAL ALUMINUM ALLOYS.** This is due to the high hardness and abrasion resistance of the fine, micron-scale SiC particle reinforcement throughout the aluminum matrix.

**AL MMCs ARE CONVENTIONALLY HEAT-TREATED. THE PRESENCE OF SiC PARTICLES IN THE ALUMINUM MATRIX ACCELERATES** precipitation aging kinetics. Peak strength (T6) through artificial aging is achieved in approximately 8 hours, while natural aging (T4) can achieve peak strength after 96 hours.

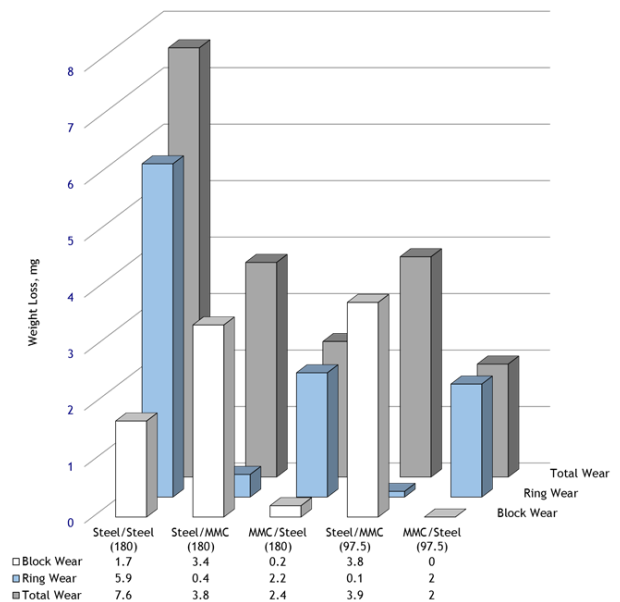
## SURFACE TREATMENTS

In general, DWA-USA Al MMCs can accept most surface treatments that are used for conventional aluminum. The fine aluminum grain size and fine to ultrafine SiC particle size distribution (PSD) translates to excellent surface treatment response compared to other Al MMCs that use far coarser reinforcement.

**CHEMICAL SURFACE CONVERSIONS** such as MIL-DTL-5541 Class 1A can easily be applied to Al MMCs without process modification.

**ANODIZING** of Al MMCs can be performed using chromic and sulfuric acid techniques.

## 6092/SiC/25p Al MMC and 4720 Steel Wear Properties (ASTM G77 Block-on-Ring)



**CONTACT US:**



21100 SUPERIOR STREET  
CHATSWORTH, CA 91311

+1-818-998-1504  
SALES@DWA-USA.COM

WWW.DWA-USA.COM