DWA ALUMINUM COMPOSITES USA

Data Sheet | 2017

2009/SiC/25p ALUMINUM MMC

2009/SiC/25p Aluminum Metal-Matrix-Composite (Al MMC) is an ideal material for automotive engine moving parts, aerospace forgings and hydraulic components. Its combination of titanium matching stiffness and enhanced strength, along with fatigue resistance 2x that of AA2024 and AA7075 cannot be matched by monolithic aluminum alloys.

TYPICAL AND MINIMUM MECHANICAL PROPERTIES

2009/SiC/25p-T4 Extruded Round Bar Density= 2.89 g/cm^3 (0.1042 lb/in^3)		F, ty MPa	F, ty ksi	F, tu MPa	F, tu ksi	elong. %
28mm (1.1in), Typical	(L)	455	66	627	91	5.2
90mm (3.75in), Typical	(L)	448	65	593	86	3.4
Minimum Properties		*Minimum Properties Have Not Been Established*				

Notes:

1) Young's Modulus is typically 116.5 GPa (16.9 msi).
2) Typical Rockwell B scale hardness is 85-88.

Data 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.

2009/SiC/25p is a powder metallurgy Al MMC comprised of AA2009 aluminum and 25 Vol% Silicon Carbide particles. It is available in vacuum-hot-pressed billet, extruded and forged product forms.

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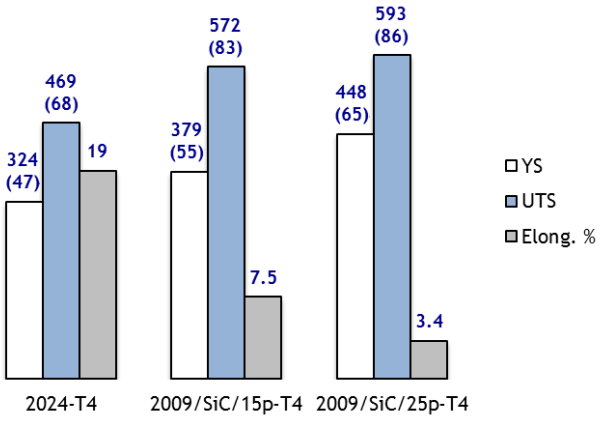
ALUMINUM METAL-MATRIX-COMPOSITES:

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.

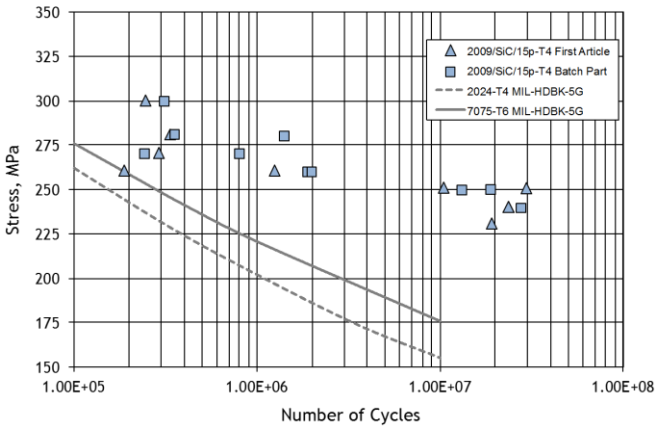
2009 Alloy Al MMC Strength, MPa (ksi)



2009 ALLOY MMC'S POSSESS ENHANCED DYNAMIC PROPERTIES SUCH AS IMPROVED FATIGUE AND CRACK GROWTH RESISTANCE as a direct result of the symbiotic relationship between the SiC reinforcing particles and the metal matrix. Together, the enhanced yield strength of the matrix and the presence of fine SiC particles retard crack growth initiation. Additionally, the presence of the fine SiC particles obstruct the path of the crack front and force the crack to follow a more tortuous path on a micro-scale. On a macro-scale, this tortuous path results in a slow progression of the overall crack front, which translates to improved fatigue resistance when compared with conventional, monolithic aluminum alloys.

DWA-USA Al MMCs also possess excellent fracture toughness. This is especially true for 2009/SiC/15p Al MMC forgings. Measured K_{IC} values range from 29-32 MPa√m (26-29 ksi√in).

2009/SiC/15p Al MMC Axial Fatigue-T4 (R= -1, Kt= 1)



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.

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