O'FALLON CASTING
NONFERROUS INVESTMENT CASTINGS

Silicon Carbide Metal Matrix Composite Alloys (SiC MMC)

This family of alloys is relatively new to designers and users of near net shape investment castings.

Silicon Carbide (SiC) particles, ranging in size from about 12 to 38 microns, are added to the standard aluminum alloys in volumes of 20 to 40 percent. 20% or 30% are more commonly specified to achieve the following advantages with lower density than other alloy alternatives.

- High Stiffness (Young's Modulus)
- Low Coefficient of Thermal Expansion (CTE)
- Long Term Dimensional Stability
- High Thermal Conductivity
- High Wear Resistance
- Good Dampening Characteristics
- Higher Strength

O'Fallon Casting has achieved much success and expertise in the casting of 20-40% Silicon Carbide Metal Matrix Composites (SiC MMC). The advantages listed above have contributed to the increased use of these alloys for the following applications.

- High Speed Automated Precision Machinery
- Silicon Wafer Processing Equipment
- Robotics
- High Quality Reflective Mirrors
- High Performance Bicycle Junctions and Components
- Brake Parts
- Optical and Laser Equipment
- Semiconductor Manufacturing Equipment

Cast Metal Matrix Composite (MMC) materials satisfy these needs and requirements. The material is readily melted and cast into complex geometries utilizing our counter-gravity casting techniques.

O'Fallon Casting's near net shape investment cast Silicon Carbide Metal Matrix Composite (SiC MMC) alloys can offer a lower cost alternative to high-Beryllium content alloy applications. Near net shape investment castings can also decrease the cost of subsequent secondary operations of these difficult to machine alloys.

When customer's requirements and annual usages justify, adjustments may be made to the base alloy (A356, A359, or A360) and the particle size to "tailor" the CTE and machinability to your specific needs. Higher silicon content of the base alloy can reduce the CTE to even lower values than those shown in the accompanying Table 1 (on reverse side), while smaller particle size can increase the machinability.

Please let our process, our expertise and this family of alloys offer a solution to your ever increasing design requirements by forwarding your inquiry to O'Fallon Casting.

EXCELLENCE

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Table 1. Typical Property Comparison for MMC and Traditional Engineering Alloys

Material		Si C Metal Matrix Composite				Class 30
Property	Units	20%	30%	40%	A356-T6	Gray Iron
Matrix	Vol %	359Al-80	359Al-70	359Al-60	-	-
Reinforcement	Vol %	20	30	40	-	-
Elastic Modulus	MSI	14.3	17.4	21.3	10.5	14.7
	Gpa	99	120	147	72	101
Density	lb/in3	0.0989	0.1011	09700	0.0970	0.2580
	g/cm3	2.74	2.80	2.81	2.69	7.14
Specific Stiffness	in x 109	144.6	172.1	205.4	108.2	57.0
	Gpa-cm3/g	36.1	42.9	51.2	26.7	14.1
Mean CTE (to 212°F)	ppm/°F	9.1	8.1	6.6	11.9	5.6
(to 100°C)	ppm/°C	17.5	14.6	11.9	21.4	10.1
Thermal Conductivity	BTU/ft-hr-°F	107	107	107	88	27
	W/m-°C	185	185	185	152	46
Specific Heat	BTU/lb-°F	0.20	0.19	0.17	0.21	0.12
	J/kg-°K	837	795	763	900	502
Tensile UTS	KSI	52	31.4	32.7	38	30
	MPa	359	216	226	262	207
Tensile YS (0.2%)	KSI	44	30.5	28.9	27	N/A
MPa	303	210	199	186	N/A	
Tensile Elongation	%	<1.0	<1.0	<1.0	5.0	N/A

Note: The above values are "typical" and are being furnished for "informational purposes" only.

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