

AEROSPACE MATERIAL SPECIFICATION



AMS 4304

Issued
Reaffirmed

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Aluminum Alloy, Discontinuously Reinforced Sheet 2009/SiC/15w (T8P) Solution Heat Treated, Stretched, and Precipitation Heat Treated

1. SCOPE:

1.1 Form:

This specification covers discontinuously reinforced aluminum alloy (DRA) metal matrix composites (MMC) in the form of sheet.

1.2 Application:

This sheet has been used typically for structural applications requiring high static strength, moderate fatigue strength, and high elastic modulus, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2202	Tolerances, Aluminum Alloy and Magnesium Alloy Sheet and Plate
MAM 2202	Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Sheet and Plate
AMS 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
MAM 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI Units)
AMS 2750	Pyrometry
AMS 2811	Identification, Aluminum and Magnesium Alloy Wrought Products

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2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 646 Fracture Toughness Testing of Aluminum Alloys
 ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products
 ASTM D 3553 Fiber Content by Digestion of Reinforced Metal Matrix Composites

3. TECHNICAL REQUIREMENTS:

3.1 Matrix Composition:

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition

Element	min	max
Copper	3.2	4.4
Magnesium	1.0	1.6
Iron	--	0.05
Silicon	--	0.25
Zinc	--	0.10
Oxygen (3.1.1)	--	0.60
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.1.1 Not required for routine acceptance

3.2 Reinforcement Type and Volume Fraction:

3.2.1 Reinforcement: Shall consist of silicon carbide whiskers (SiCw) having the following characteristics:

Crystal structure - Beta and alpha
 Color - Gray-green
 Width - One-half micrometer
 Length - Up to 100 micrometers

3.2.2 Reinforcement Volume Fraction: The content of silicon carbide whiskers shall be 0.15% " 0.02, determined in accordance with ASTM D 3553.

3.3 Condition:

Solution heat treated, stretched one-half to 1%, and precipitation heat treated to T8P condition. Pyrometry shall be in accordance with AMS 2750.

3.4 Properties:

Sheet shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355:

- 3.4.1 Tensile Properties: Shall be as shown in Table 2 for sheet 0.060 to 0.130 inch (1.52 to 3.30 mm), inclusive, in thickness.

TABLE 2 - Minimum Tensile Properties

Property	Specimen Orientation	Value
Tensile Strength	L	85.0 ksi (586 MPa)
	LT	71.0 ksi (490 MPa)
Yield Strength	L	64.0 ksi (441 MPa)
	LT	52.0 ksi (359 MPa)
Strain to Failure (One-inch gage)	L	3.3%
	LT	5.1%

- 3.4.2 Compressive Yield Strength: When specified, shall be not less than 58.0 ksi (400 MPa) in the longitudinal direction and not less than 55.0 ksi (379 MPa) in the transverse direction for sheet 0.060 to 0.130 inch (1.52 to 3.30 mm), inclusive, in thickness.

- 3.4.3 Fracture Toughness: When specified, the critical stress intensity factor (K_{IC}) shall be not less than 40 ksi $\sqrt{\text{inch}}$ (44 MPa $\sqrt{\text{m}}$) for sheet 0.070 to 0.090 inch (1.78 to 2.29 mm), inclusive, in thickness, determined in the L-T direction with 4 inch (102 mm) wide specimens in accordance with ASTM B 646.

3.5 Quality:

Sheet, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the sheet.

3.6 Tolerances:

Shall conform to all applicable requirements of AMS 2202 or MAM 2202.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of sheet shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the sheet conforms to the requirements of this specification.

4.2 Classification of Tests:

Tests for composition of matrix (3.1), reinforcement type and volume fraction (3.2), longitudinal and long-transverse tensile properties (3.4.1), and when specified, compressive yield strength (3.4.2) and fracture toughness (3.4.3), and tolerances (3.6) are acceptance tests and shall be performed on each lot.

4.3 Sampling and Testing:

With the following exceptions, shall be in accordance with AMS 2355 or MAM 2355:

4.3.1 Longitudinal and long-transverse tensile properties shall be measured.

4.3.2 When specified, sampling and testing for determination of compressive yield strength and for critical-stress-intensity factor shall be as agreed upon by purchaser and vendor.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report stating that the product conforms to the chemical composition of the matrix and the volume fraction of the reinforcement component, and showing the results of tests to determine conformance to the other acceptance test requirements. This report shall include the purchase order number, lot number, AMS 4304, size, and quantity.

4.5 Resampling and Retesting:

If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing two additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented. Results of all tests shall be reported.

5. PREPARATION AND DELIVERY:

5.1 Identification:

Shall be in accordance with AMS 2811.