SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7851C

Issued MAR 1966
Revised OCT 2003
Reaffirmed JUN 2008

Superseding AMS 7851B

Columbium (Niobium) Alloy Foil, Sheet, Strip, and Plate, 10W - 2.5Zr Recrystallized

(Composition similar to UNS R04271)

1. SCOPE:

1.1 This specification covers a columbium (niobium) alloy in the form of foil, sheet, strip, or plate.

1.2 Application:

This material has been used typically for parts requiring exposure at ultra high-temperatures, but usage is not limited to such applications. Applications in oxidizing atmospheres necessitate a protective coating.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2242 Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate

AMS 2809 Identification, Titanium and Titanium Alloy Wrought Products

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 21	Elevated Temperature Tension Tests of Metallic Materials
ASTM E 92	Vickers Hardness of Metallic Materials
ASTM E 290	Bend Testing Material for Ductility

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1. Metallic elements shall be determined by spectrochemical methods or by other analytical methods acceptable to purchaser, carbon shall be determined by conductometric methods, oxygen shall be determined by the vacuum fusion or conductometric method, nitrogen shall be determined by the Kjeldahl method, and hydrogen shall be determined by the vacuum extraction method:

Table 1 - Composition

Element	min	max	
Tungsten	9.0	11.0	
Zirconium	2.0	3.0	
Tantalum	--	0.15	
Carbon	--	0.030	
Silicon	--	0.02	
Iron	--	0.02	
Titanium	--	0.01	
Oxygen	--	0.020	(200 ppm)
Nitrogen	--	0.010	(100 ppm)
Hydrogen	--	0.001	(10 ppm)
Columbium (Niobium)	remainder		

3.2 Condition:

Cold rolled or hot-cold rolled, descaled, and recrystallized.

3.3 Heat Treatment:

Product shall be recrystallized by heating to a temperature within the range 2200 to 2400 °F (1204 to 1316 °C) under vacuum of absolute pressure less than 0.1 micron (0.1 µm) mercury or inert atmosphere or as agreed upon by purchaser and vendor.

3.4 Properties:

The product shall conform to the following requirements:

3.4.1 Tensile Properties: Product, 0.010 to 0.060 inch (0.25 to 1 .52 mm), inclusive, in nominal thickness, shall meet the requirements of 3.4.1.1 and 3.4.1.2.

3.4.1.1 At Room Temperature: Shall be as shown in Table 2 for sheet and strip 0.010 to 0.060 inch (0.25 to 1.52 mm), inclusive, in nominal thickness, determined in accordance with ASTM E 8 or ASTM E 8M with the rate of strain maintained at 0.003 to 0.007 inch/inch/minute (0.003 to 0.007 mm/mm/minute) through the yield strength and at 0.03 to 0.07 inch/inch/minute (0.03 to 0.07 mm/mm/minute) above the yield strength.

Table 2 – Minimum Tensile Properties at Room Temperature

Property	Value
Tensile Strength	75 ksi (517 MPa)
Yield Strength at 0.2% Offset	60 ksi (414 MPa)
Elongation in 1 Inch (25.4 mm)	15%

3.4.1.2 At 2200 °F (1204 °C): Product 0.010 to 0.060 inch (0.025 to 1 .52 mm), inclusive, in nominal thickness shall meet the requirements shown in Table 3 when heated to 2200 °F ± 10 (1204 °C ± 6) under vacuum (less than 0.1 micron mercury) or an inert atmosphere, held at heat for 15 minutes before testing, and tested at 2200 °F ± 10 (1204 °C ± 6) at a strain rate of 0.03 to 0.07 inch/inch/minute (0.03 to 0.07 mm/mm/minute) in accordance with ASTM E 21:

Table 3 – Minimum Tensile Properties at 2200°F (1204°C)

Property	Value
Tensile Strength	30.0 ksi (207 MPa)
Yield Strength at 0.2% Offset	25.0 ksi (172 MPa)
Elongation in 1 Inch (25.4 mm)	15%

3.4.2 Hardness: Shall be not higher than 225 HV30, or equivalent, determined in accordance with ASTM E 92.

3.4.3 Bending: Product shall have a test sample prepared nominally 0.750 inch (19.06 mm) in width with axis of bending parallel to the direction of rolling. The sample shall be bend tested in conformance with the guided bend test defined in ASTM E 290 through the angle shown in Table 4. The test fixture supports shall have a minimum contact radius of 0.010 inch (0.25 mm) and the plunger shall have a radius equal to one times the nominal thickness. The bent sample shall show no evidence of cracking when examined at 15 to 25X magnification.

Table 4 – Minimum Bend Angle

Nominal Thickness		Angle degree
Inches	Millimeters	
0.001 to 0.060, incl	0.025 to 1.52, incl	180
Over 0.060	Over 1.52	90

3.4.4 Microstructure: Product shall show a structure consisting essentially of recrystallized grains; additional standards for acceptance shall be as agreed upon by purchaser and vendor (See 8.4).

3.5 Quality:

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

3.6 Tolerances:

Shall conform to all applicable requirements of AMS 2242, except flatness shall conform to the following:

3.6.1 Flatness: When measured using a straight-edge touching the product at two points, the perpendicular distance from the straight-edge to the sheet or plate shall not exceed 0.05 x L inches (millimetres) at any point between the two points of contact, where "L" is the distance in inches (mm) between the two points of contact.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), room temperature tensile properties (3.4.1.1), hardness (3.4.2), bending (3.4.3), microstructure (3.4.4), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Elevated temperature tensile properties (3.4.1.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.