

S-200-F, S-200-FC and S-200-FH Structural-Grade Beryllium

Materion produces high-purity beryllium metals in a variety of structural grade specifications that provide exceptional stiffness-to-weight and strength-to-weight ratios. S-200-F, S-200-FC and S-200-FH are also low-density materials that allow for weight and volume reductions without a loss in durability. They feature high heat resistance and thermal stability at cryogenic temperatures. Applications include satellites, telescopes, reconnaissance systems, semiconductor equipment, aerospace instrumentation panels, fire control, forward-looking infrared (FLIR) systems and optical targeting systems.

S-200-F is produced through the consolidation of beryllium powder by vacuum hot pressing. It is used as an optical substrate and support bench in multiple applications.

S-200-FC is produced by cold isostatic pressing with subsequent sintering. It has lower tensile properties than other grades, but the modulus and thermal properties are the same.

S-200-FH is hot isostatic pressed beryllium which provides isotropic properties along with slightly higher density and greater strength than vacuum hot-pressed or cold isostatic pressed and sintered beryllium.

Chemical Composition

Compounds	Composition (wt%)
Beryllium (Be) Assay - minimum	98.5
Beryllium Oxide (BeO) - maximum	1.50
Aluminum (Al) - maximum	0.10
Carbon (C) - maximum	0.15
Iron (Fe) - maximum	0.13
Magnesium (Mg) - maximum	0.08
Silicon (Si) - maximum	0.06
Other Metallic Impurities - maximum	0.04

Typical Physical Properties

Density*	Elastic Modulus	Solidus	Specific Heat Capacity	Thermal Conductivity @ 25°C	Thermal Expansion @ 25-100°C
1.85 g/cm ³ 0.067 lb./in ³	290 GPa 42 msi	1287°C 2349°F	1.95 J/g°C 0.46 BTU/lb./°F	216 W/m·K 125 BTU/hr·ft·°F	11.3 ppm/°C 6.3 ppm/°F

*The minimum bulk density is 99.0% of theoretical density for S-200-F and S-200-FC and 99.7% for S-200-FH, which is determined using the water displacement method.

Mechanical Properties

This table shows the minimum tensile properties for the indicated material at room temperature, as determined per ASTM E8:

	S-200-F	S-200-FC	S-200-FH
Ultimate Tensile Strength, MPa (ksi), min	324 (47)	262 (38)	414 (60)
Yield Strength (0.2% offset), MPa (ksi), min	241 (35)	172 (25)	296 (43)
Elongation (% in 4 diameters), min	2.0	2.0	3.0

Tolerances for S-200-F and S-200-FH

Materials furnished under this specification shall conform to the dimensions and dimensional tolerances established by the purchase order and applicable drawings. If tolerances are not specified by the purchase order, the following standard tolerances shall apply to the specified materials, employing ANSI/ASME Y14.5:

Diameter, Width or Thickness	Tolerance S-200-F, S-200-FH
Up to 76 mm (3"), inclusive*	-0 / +0.40 mm (-0 / +1/64")
Over 76 to 508 mm (3" to 20"), inclusive	-0 / +1.59 mm (-0 / +1/16")
Over 508 mm (20")	-0 / +6.35 mm (-0 / +1/4")

Length	Tolerance S-200-F, S-200-FH
Up to 508 mm (20"), inclusive	-0 / +3.18 mm (-0 / +1/8")
Over 508 mm (20")	-0 / +6.35 mm (-0 / +1/4")

*For S-200-F grade beryllium less than 6.3 mm (.25") thick, SR-200 sheet and PS-200 foil are also available. The properties are described on their respective data sheets.

Non-Destructive Testing

Penetrant inspection can be performed when requested on the purchase order. Penetrant inspection shall be performed per ASTM E1417 using penetrants and a dry developer conforming to MIL-I-25135, Type 1, Level 2, Method B, Form A. Personnel performing this inspection shall be certified in accordance with NAS-410.

Radiographic inspection is for fully machined parts only when specified on the purchase order. Radiographic inspection to a penetrometer sensitivity of 2% shall be performed in accordance with ASTM E1742. A 10" (254 mm) maximum thickness of beryllium can be inspected with radiography.

Exceptions are taken to the penetrometer contrast requirements and applicable area of penetrometer density ranges of +30% or -15% from the density at penetrometer location(s). Unless otherwise specified, accept/reject decisions shall include areas directly beneath the penetrometer(s).

Forms Available

S-200-F is vacuum hot pressed and available in rod and bar forms. It can be certified to the SAE-AMS7906 specification.

S-200-FC is produced from beryllium powder consolidated by cold isostatic pressing and sintering. It can be certified to the SAE-AMS7910 specification and is only available in special shapes based on part size.

S-200-FH is formed by hot isostatically pressing beryllium powder and can be formed into regular or custom shapes. It can be certified to the SAE-AMS7908 specification and is available in rod, bar and special shapes.

Related Information

Certification of compliance with this specification will be furnished upon request. When requested, actual test results will be certified. Testing in accordance with the individual customer's instructions will be performed if mutually acceptable, and actual test results will be certified.

The method of packaging, labeling and shipping will be in accordance with applicable government regulations. Special packaging will be provided when mutually acceptable and in accordance with government regulations. Each container of S-200-F, S-200-FC and S-200-FH will be legibly marked with the following information: company name, material lot or part number, serial number, specification number, X-ray number, purchase order number, and beryllium warning information.

Health and Safety

Processing beryllium-containing alloys poses a health risk if safe practices are not followed. Inhalation of airborne beryllium can cause serious lung diseases in some individuals. Occupational safety and health regulatory agencies worldwide have set mandatory limits on occupational respiratory exposures. Read and follow the guidance in the Safety Data Sheet (SDS) before working with this material. The SDS and additional important beryllium health and safety information and guidance can be found at berylliumssafety.com, berylliumssafety.eu and Materion.com. For questions on safe practices for beryllium-containing alloys, contact the Materion Product Stewardship Group at +1.800.862.4118 or contact us by email at Materion-PS@Materion.com.

Disclaimer:

Only the buyer can determine the appropriateness of any processing practice, end-product or application. Materion does not make any warranty regarding its recommendations, the suitability of Materion's product, or its processing suggestions for buyer's end product, application or equipment.

The properties presented on this data sheet are for reference purposes only, intended only to initiate the material selection process. They do not constitute, nor are they intended to constitute, a material specification. Material will be produced to one of the applicable industry standards, if any, listed in the Industry Standards and Specification section.

Actual properties may vary by thickness and/or part number. Please contact your local sales engineer for detailed properties to be used in simulation.

Any properties marked as preliminary are subject to change at any time as the manufacturing process is further refined.