

S-65 and S-65-H Nuclear-Grade Beryllium

Pure beryllium metals S-65 and S-65-H are engineered to maintain their properties at elevated temperatures to increase efficiency and reduce hazardous waste production. Both materials offer high thermal conductivity, low neutron absorption and superior cracking resistance under high heat flux thermal cycling.

S-65 has the lowest impurity levels of commonly made grades of beryllium, which reduces transuranic elements and the required storage time after being removed from reactors.

Applications include reactor walls and reflector tiles, breeder pebbles, neutron reflectors and modulators and other components in nuclear test reactors and medical isotope reactors.

Chemical Composition

Compounds	Composition (wt%)
Beryllium (Be) Assay - minimum	99.2
Beryllium Oxide (BeO) - maximum	0.90
Aluminum (Al) - maximum	0.05
Carbon (C) - maximum	0.09
Iron (Fe) - maximum	0.08
Magnesium (Mg), Chromium (Cr) - maximum	0.01 each
Nickel (Ni), Copper (Cu), Titanium (Ti), Zirconium (Zr) - maximum	0.025 each
Zinc (Zn), Manganese (Mn), Silver (Ag), Cobalt (Co), Lead (Pb), Calcium (Ca), Molybdenum (Mo) - maximum	0.005 each
Silicon (Si) - maximum	0.045
Uranium (U) - maximum *	0.015
Other Metallic Impurities - maximum	0.04

*S-65 and S-65-H can be provided with much lower uranium content upon request.

Typical Physical Properties

Density*	Elastic Modulus	Solidus	Specific Heat Capacity	Thermal Conductivity @ 25°C	Thermal Expansion @ 20-100°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-65 and 99.7% for S-65-H. Density is determined using the water displacement method.

Data Sheet continued

Typical Mechanical Properties*

Minimum tensile properties for the material at room temperature, as determined per ASTM E8 and MAB-205 M:

	S-65	S-65-H
Ultimate Tensile Strength, MPa (ksi), min	290 (42)	345 (50)
Yield Strength (0.2% offset), MPa (ksi), min	207 (30)	207 (30)
Elongation (% in 4 diameters), min	3.0	2.0

Dimensional Tolerances

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 employing ANSI/ASME Y14.5:

Diameter, Width or Thickness	Tolerance
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
Up to 508 mm (20"), inclusive	-0 / +3.18 mm (-0 / +1/8")
Over 508 mm (20")	-0 / +6.35 mm (-0 / +1/4")

Non-Destructive Testing

Penetrant inspection can be performed when requested on the purchase order. Penetrant inspection shall be performed per ASTM E1417 using penetrant 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 AMS-410 and MIL-STD-410.

Radiographic inspection to a penetrameter sensitivity of 2% shall be performed in accordance with ASTM E1742. A maximum thickness of 254 mm (10") of beryllium can be inspected with radiography.

Forms Available

S-65 is available in pieces cut from a vacuum pressed block. S-65-H is available in pieces cut from a hot isostatically pressed block.

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 will be legibly marked with the following minimum 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 berylliumsafety.com, berylliumsafety.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.