

General information

Designation

Bismuth Metal (as sold on world commodity markets)

Typical uses

Alloying element; Pharmaceuticals; Electronics; Catalysts; Cosmetics; Pigments; Medicines; Thermocouples; Carrier for Uranium fuel in nuclear reactors; Fire sensing equipment;

Composition overview

Compositional summary

Bi100

Material family	Metal (other)
Base material	Bi (Bismuth)

Composition detail (metals, ceramics and glasses)

Bi (bismuth)	100	%
--------------	-----	---

Price

Price	* 10.9	-	13.4	USD/lb
-------	--------	---	------	--------

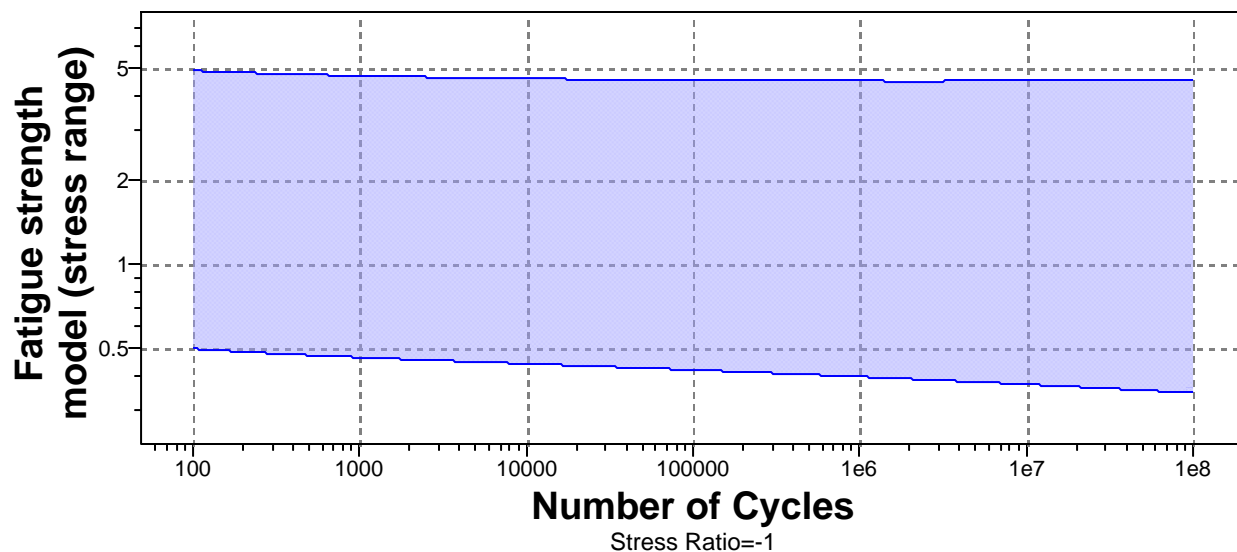
Physical properties

Density	0.352	-	0.354	lb/in ³
---------	-------	---	-------	--------------------

Mechanical properties

Young's modulus	4.79	-	5.08	10 ⁶ psi
Yield strength (elastic limit)	* 0.29	-	2.03	ksi
Tensile strength	0.58	-	2.9	ksi
Elongation	* 20	-	30	% strain
Compressive strength	* 0.29	-	2.03	ksi
Flexural modulus	* 4.79	-	5.08	10 ⁶ psi
Flexural strength (modulus of rupture)	* 0.29	-	2.03	ksi
Shear modulus	1.74	-	1.96	10 ⁶ psi
Bulk modulus	4.5	-	5.22	10 ⁶ psi
Poisson's ratio	0.325	-	0.335	
Shape factor	30			
Hardness - Vickers	* 5	-	10	HV
Fatigue strength at 10 ⁷ cycles	* 1.16	-	1.45	ksi
Fatigue strength model (stress range)	* 0.373	-	4.51	ksi

[Parameters](#): Stress Ratio = -1, Number of Cycles = 1e7cycles



Mechanical loss coefficient (tan delta)	* 0.02	-	0.2
---	--------	---	-----

Impact & fracture properties

Fracture toughness	* 4.55	-	18.2	ksi.in ^{0.5}
--------------------	--------	---	------	-----------------------

Thermal properties

Melting point	513	-	522	°F
Maximum service temperature	464	-	482	°F
Minimum service temperature	-459			°F
Thermal conductivity	4.68	-	5.03	BTU.ft/hr.ft ² .°F
Specific heat capacity	0.0275	-	0.031	BTU/lb.°F
Thermal expansion coefficient	7.22	-	7.56	μstrain/°F
Latent heat of fusion	20.6	-	24.1	BTU/lb

Electrical properties

Electrical resistivity	105	-	109	μohm.cm
Galvanic potential	* -0.25	-	-0.17	V

Magnetic properties

Magnetic type	Non-magnetic
---------------	--------------

Optical properties

Transparency	Opaque
--------------	--------

Durability

Water (fresh)	Excellent
Water (salt)	Excellent

Weak acids	Acceptable
Strong acids	Unacceptable
Weak alkalis	Acceptable
Strong alkalis	Limited use
Organic solvents	Excellent
Oxidation at 500C	Unacceptable
UV radiation (sunlight)	Excellent
Galling resistance (adhesive wear)	Limited use
Flammability	Non-flammable

Primary production energy, CO2 and water

Embodied energy, primary production	* 5.93e4	-	6.53e4	BTU/lb
CO2 footprint, primary production	* 8.63	-	9.51	lb/lb
Water usage	* 7.75e4	-	8.55e4	in^3/lb

Processing energy, CO2 footprint & water

Casting energy	* 2.27e3	-	2.5e3	BTU/lb
Casting CO2	* 0.395	-	0.437	lb/lb
Casting water	* 276	-	414	in^3/lb
Rough rolling, forging energy	* 137	-	152	BTU/lb
Rough rolling, forging CO2	* 0.0239	-	0.0265	lb/lb
Rough rolling, forging water	* 46.8	-	70	in^3/lb
Extrusion, foil rolling energy	* 152	-	168	BTU/lb
Extrusion, foil rolling CO2	* 0.0265	-	0.0293	lb/lb
Extrusion, foil rolling water	* 47.1	-	70.6	in^3/lb
Wire drawing energy	* 233	-	258	BTU/lb
Wire drawing CO2	* 0.0407	-	0.045	lb/lb
Wire drawing water	* 5.54	-	8.58	in^3/lb
Metal powder forming energy	* 1.79e3	-	1.99e3	BTU/lb
Metal powder forming CO2	* 0.334	-	0.37	lb/lb
Metal powder forming water	* 126	-	189	in^3/lb
Vaporization energy	* 8.89e5	-	9.83e5	BTU/lb
Vaporization CO2	* 155	-	171	lb/lb
Vaporization water	* 2.39e4	-	3.58e4	in^3/lb
Coarse machining energy (per unit wt removed)	* 206	-	228	BTU/lb
Coarse machining CO2 (per unit wt removed)	* 0.036	-	0.0398	lb/lb
Fine machining energy (per unit wt removed)	* 226	-	250	BTU/lb
Fine machining CO2 (per unit wt removed)	* 0.0395	-	0.0436	lb/lb
Grinding energy (per unit wt removed)	* 248	-	275	BTU/lb
Grinding CO2 (per unit wt removed)	* 0.0433	-	0.0479	lb/lb

Non-conventional machining energy (per unit wt removed)	* 8.89e3	-	9.83e3	BTU/lb
Non-conventional machining CO2 (per unit wt removed)	* 1.55	-	1.71	lb/lb

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 1.09e4	-	1.2e4	BTU/lb
CO2 footprint, recycling	* 1.99	-	2.2	lb/lb
Recycle fraction in current supply	9.59	-	10.6	%
Downcycle	✓			
Combust for energy recovery	✗			
Landfill	✗			
Biodegrade	✗			

Notes

Warning

Excess bismuth can cause mild kidney damage to humans;

Other notes

Bismuth is one of the less toxic heavy metals. It has a silver luster with a pink tinge.

Links

ProcessUniverse
Producers
Reference
Shape