

NiCrMo Superalloy Hastelloy B2 (UNS N10665)



Hastelloy B2 offers great resistance to reducing acids, organic acids and stress corrosion cracking. It is resistant to non-oxidizing acids and avoids the production of embrittlement phase in the welded form. Therefore it is also suitable for use in chemical processing plants in welded form.

Alloy B-2 is an excellent corrosion resistance material in the reducing conditions like hydrogen chloride gas, sulfuric acid, acetic and phosphoric acid. It offers resistance to the pure sulfuric acid and various non-oxidizing acids. It is not preferred for using in the oxidizing environments. The corrosion failure may occur when the alloy is employed in the iron or copper medium in the presence of hydrochloric acid.

Chemical Composition

Nickel (Ni)	Rem %
Chromium (Cr)	1 %
Molybdenum (Mo)	26 to 30 %
Silicon (Si)	0.1 %
Carbon (C)	0.02 %
Sulfur (S)	0.03 %
Phosphorous (P)	0.04 %
Cobalt (Co)	1%
Iron (Fe)	2 %

Physical Properties

Density	0.333 lb/in ³	
Electric resistivity	824 Ohm - circ mil/ft	
Temperature, of	Coefficient of thermal expansion, in/in.oF x 10 ⁽⁻⁶⁾	Thermal conductivity, Btu.ft/ft ² .hr.of
32 of	-	6.4
212 of	6	7.1
392 of	6	7.7
572 of	6.5	8.4

Mechanical Properties

Annealed Alloy form	Tensile strength	Yield strength	Elongation
Rod & bar	110	51	40
Sheet & plate	110	51	40
Welded pipe & tube	110	51	40
Seamless pipe & tube	110	45	40

Dynamic modulus of elasticity

Form	Condition	temperature		Dynamic modulus of elasticity	
		oC	oF	GPa	10(5) psi
Alloy B2 plate, 13 mm (0.5 inch) thickness	heat processed at 1065oC or 1950oF, quickly cooled	Room temperature	Room temperature	217	31.4
		315	600	202	29.3
		425	800	196	28.4
		540	1000	189	27.4

Thermal Diffusivity

Temperature		Diffusion coefficient, 10(-6) inch ² /sec
oC	oF	
0 oC	32 oF	3.5
100 oC	212 oF	3.4
200 oC	390 oF	3.6
300 oC	570 oF	3.8
400 oC	750 oF	4
500 oC	930 oF	4.2

Electric Resistivity

Temperature		Resistivity, micro-ohm-meter
oC	oF	
0 oC	32 oF	1.37
100 oC	212 oF	1.38
200 oC	390 oF	1.38
300 oC	570 oF	1.39
400 oC	750 oF	1.39
500 oC	930 oF	1.41

Corrosion Resistance

In the commercial units Hastelloy B-2 alloy is implemented as a corrosion resistance material to a large series of organic acids. It offers excellent resistance to chloride-induced stress-corrosion breaking.

Hastelloy B-2 is an ideal material for using in the diverse chemical processes in the as-welded situation. This is because it offers resistance to an arrangement of granule margin carbide precipitates in the weld heating zones that have minimized precipitation of carbides and other forms to ensure the uniform resistance to corrosion. It also offers resistance to pitting corrosion.

Alloy B-2 has superior resistance to hydrochloric acid, aluminum chloride catalyst and other powerful reduction chemicals. It has outstanding elevated temperature stability in the inert and vacuum conditions. It is suitable for the device maintenance in the reduction and chemical conditions.

The operations in the chemical processing include handling sulfuric acid, phosphoric acid, hydrochloric acid and acetic acid. The operation temperatures vary from the ambient to 1500oF on the base of environments.

Mean corrosion rate of Hastelloy B2 in boiling acids

Environment	Content weight %	Mean corrosion rate	
		Mm per year	Mils per year
Acetic acid	10	Below 0.02 mmy	0.5 mpy
	30	0.01 mmy	0.4 mpy
	50	0.01 mmy	0.4 mpy
	70	Below 0.01 mmy	0.3 mpy
	99 glacial	Below 0.01 mmy	0.3 mpy
Formic acid	10	Below 0.01 mmy	0.3 mpy
	20	Below 0.02 mmy	0.6 mpy
	30	Below 0.02 mmy	0.7 mpy
	40	Below 0.02 mmy	0.7 mpy
	60	Below 0.02 mmy	0.5 mpy
	89	Below 0.02 mmy	0.5 mpy
Hydrochloric acid	1	0.02 mmy	0.8 mpy
	2	0.08 mmy	3 mpy
	5	0.13 mmy	5 mpy
	10	0.18 mmy	7 mpy
	15	0.28 mmy	11 mpy
	20	0.38 mmy	15 mpy
	20	0.51 mmy	20 mpy
Phosphoric acid	10	0.05 mmy	2 mpy
	30	0.08 mmy	3 mpy
	50	0.15 mmy	6 mpy
	85	0.63 mmy	25 mpy
Sulfuric acid	2	Below 0.02 mmy	0.5 mpy
	5	0.08 mmy	3 mpy
	10	0.05 mmy	2 mpy
	20	Below 0.02 mmy	0.7 mpy

	30	Below 0.02 mmy	0.7 mpy
	40	Below 0.03 mmy	0.9 mpy
	50	0.03 mmy	1 mpy
	50	0.05 mmy	2 mpy
	50	0.03 mmy	1 mpy
	60	0.05 mmy	2 mpy
	70	0.23 mmy	9 mpy

Machining of Alloy B-2

Nickel-Cobalt alloys offering resistance to corrosion at high temperature and wearing resistance are categorized as intermediate to tough while machining however it is stated that the alloys are machined inexpensively.

While machining these alloys get toughen quickly and produce broad heat while cutting, welding to the cutting tool offers wide resistance to the metal removal because of large shear forces. The following factors help in achieving the necessary machining applications:

Capacity: The device should be strong and extremely overpowered.

Firmness: The sample and tools should be placed firmly. Decrease the tool overhang.

Sharp Tools: The apparatus should be very sharp during operation. For this, the tools should be changed after certain time use.

Available Forms

Wire, Mesh, Strip, Sheet, Rod, Bar, Tubing, Pipe, Flanges, Foil