Hastelloy B-3 Alloy

Heanjia Super Metals Co., Ltd

The **Hastelloy B-3 alloy** is a member of Nickel - Molybdenum alloy family that provides superior resistance to hydrochloric acid in the all concentration and temperature limits. The alloy offers superior resistance to sulfuric, acetic, formic and phosphoric acids and other non-oxidizing media. The Hastelloy B-3 alloy is comprised of good chemical structure to obtain the fine thermal stabilization. It provides outstanding resistance to pitting corrosion and stress corrosion cracking and heated sections.

Chemical composition of Hastelloy B-3 alloy

Ni	Mo	Cr	Fe	Co	W	Mn	Al	Ti	Si	C
65	28.5	1.5	1.5	3*	3	3	0.5	0.2	0.1	0.01

Formation

The improved thermal firmness of B-3 alloy reduces the complications of fabrication of components of B-2 alloy. This is feasible due to minimum capacity of alloy to precipitate the toxic intermetallic phases in B-3 alloy, so it receives more ductility over B-2 alloy in the various thermal cycling environments. The B-3 alloy offers an improved overall formation and weldable features. It can be forged or hot processed at the temperatures of 2250oF or 1230oC for time required to get the entire sample at the same temperature limit. The B-2 alloy is a low carbon concentration material, the reduced hot finishing temperatures are required to obtain the controlled grain size.

Physical Properties of Hastelloy B-3 alloy

Thermal Conductivity	78 Btu-in./ft.2 hr.-°F	At room temperature
	83 Btu-in./ft.2 hr.-°F	200 oF
	93 Btu-in./ft.2 hr.-°F	400oF
	104 Btu-in./ft.2 hr.-°F	600oF
Specific Heat	0.089 Btu/lb.-°F	At room temperature
	0.092 Btu/lb.-°F	200 oF
	0.098 Btu/lb.-°F	400oF
	0.102 Btu/lb.-°F	600oF
Density	0.333 lb/in.3	At room temperature
Melting Point	2500-2585oF	
Electrical Resistivity	53.8 microhm-in	At room temperature
Mean Coefficient of Thermal Expansion	5.7 microinches/in.-°F	78-200
Thermal Diffusivity	4.6 x 10-3 in.2/sec	At room temperature

Dynamic Modulus of elasticity

Temperature, oF	Dynamics of modulus of elasticity, 10-6 psi
Room	31.4
200	30.9
400	30.1
600	29.3
800	28.3
1000	27.2

Tensile Properties

Temp, oF	Tensile Strength, ksi	Yield Strength, ksi	Elongation %

Room	125.0	60.6	53.4
200	120.7	55.3	56.9
400	110.0	47.0	59.7
600	104.4	43.5	63.4
800	102.0	42.4	62.0
1000	97.8	39.0	59.0
1200	103.5	45.8	55.8

Corrosion Resistance

The resistance to corrosion offered by the **Hastelloy B-3 alloy** is shown in the below table:

Acid	Concentration by weight	Corrosion rate per year, mm
Acetic Acid	10	0.005
Formic Acid	20	0.015
Hydrochloric Acid	1	0.005
Phosphoric Acid	30	0.05
Sulfuric Acid	2	0.010

Corrosion resistance in boiling acids

Acid Medium	**Average Corrosion Rates Per Year, Mils (mm)**			
	B-3®	B-2	316L	Monel 400 alloy
50% Acetic Acid	0.2 (0.005)	0.4 (0.010)	0.2 (0.005)	-
40% Formic Acid	0.5 (0.013)	0.7 (0.018)	41 (1.041)	2.1 (0.053)
50-55% Phosphoric Acid	3.0 (0.076)	6 (0.152)	18 (0.457)	4.5 (0.114)
50% Sulfuric Acid	1.7 (0.043)	1.2 (0.030)	>20,000 (>500)	185 (4.699)
20% Hydrochloric Acid	12 (0.305)	15 (0.381)	>20,000 (>500)	1587 (40.310)

Aqueous corrosion resistance

% Cold processing	Hardness, Rc	Tensile Strength, ksi	Yield Strength, ksi	Elongation, %	Annual Corrosion rate (mm)
0	18	125	62	57	0.33
10	30	140	100	40	0.33
20	37	159	130	25	0.33
30	41	180	154	13	0.33
40	44	202	172	9	0.33
50	46	221	183	8	0.33

The Hastelloy B-3 alloy can also be fabricated by cold processing. It is toughened quickly, the B-3 alloy parts can be fabricated by using the famous fabrication methods. The controlled analysis in boiling 20 % hydrochloric acid shows that the symmetric resistance to corrosion of B-3 alloy is not affected by cold reduction about 50% than the alloy in the solution hot processed form. The **Hastelloy B-3 alloy** is welded by following the traditional welding processes though oxyacetylene and submerged arc welding are not preferred when the formed material is required to use in the corrosion service. The special care is made to avoid the broad heating.

Heat Processing

The wrought forms of B-3 alloy are furnished in the hot processed solution. The alloy is heat treated at the temperature of 1950oF or 1065oC and quick cooling except the shining annealed sheet and coil forms that are heat processed at the temperature of 2100oF or 1150oC and quenched.

Applications of Hastelloy B-3 Alloy

The **Hastelloy B-3 alloy** is suitable for employing in the various fields similar to the Hastelloy B-2 alloy. Just like B-2 alloy, the B-3 alloy is not preferred for employing in the ferric or cupric salts because these salts cause the rapid corrosion of alloy. The ferric or cupric salts may be produced when the hydrochloric acid is placed in the contact of iron or copper metals.

Hastelloy B Product Forms Available:

Wire, Wiremesh Screen, Strip, Sheet, Rod, Pipe, Bar, Tubing, Plate, Ribbon, Tape

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