Haynes HastelloyÂ® Hybrid-BC1Â® Nickel Alloy Bar, Hot Rolled and Solution Annealed

Category : Metal , Nonferrous Metal , Nickel Alloy

Material Notes:

HASTELLOYÂ® HYBRID-BC1Â® alloy possesses much higher resistance to hydrochloric and sulfuric acids than the nickel-chromium-molybdenum (C-type) alloys, and can tolerate the presence of oxidizing species. The alloy also exhibits extremely high resistance to pitting and crevice corrosion. HYBRID-BC1 alloy is available in the form of plate, sheet, strip, billet, bar, wire, pipe, and tube. HYBRID-BC1 alloy is suitable for the following applications in the chemical processing, pharmaceutical, agricultural, food, petrochemical, and power industries: Reaction vessels Heat exchangers Valves Pumps Piping Storage tanks The alloy is suitable for use at temperatures up to approximately 427Â°C (800Â°F). HYBRID-BC1 alloy excels in reducing acids and acid mixtures (with or without halides) open to oxygen and other oxidizing residuals/contaminants. Heat Treatment: Wrought forms of HYBRID-BC1 alloy are furnished in the solution annealed condition, unless otherwise specified. The standard solution annealing treatment consists of heating to 1149Â°C (2100Â°F) followed by rapid air-cooling or (preferably) water quenching. Parts which have been hot formed should be solution annealed prior to final fabrication or installation. The minimum hot forming temperature of the alloy is 954Â°C (1750Â°F). Forming: HYBRID-BC1 alloy has excellent forming characteristics, and cold forming is the preferred method of shaping. The alloy can be easily cold worked due to its high ductility; however, the alloy is stronger than the austenitic stainless steels and therefore requires more energy during cold forming.Data provided by the manufacturer, Haynes International, Inc.

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Physical Properties	Metric	English	Comments
Density	8.83 g/cc	0.319 lb/inÂ³	

Mechanical Properties	Metric	English	Comments
Tensile Strength, Ultimate	705 MPa @Thickness 25.4 mm, Temperature 427 Â°C	102000 psi @Thickness 1.00 in, Temperature 801 Â°F	
	712 MPa @Thickness 25.4 mm, Temperature 371 Â°C	103000 psi @Thickness 1.00 in, Temperature 700 Â°F	
	714 MPa @Thickness 25.4 mm, Temperature 316 Â°C	104000 psi @Thickness 1.00 in, Temperature 601 Â°F	
	725 MPa @Thickness 25.4 mm, Temperature 260 Â°C	105000 psi @Thickness 1.00 in, Temperature 500 Â°F	
	743 MPa	108000 psi	

Mechanical Properties	Metric	English	Comments
	@Thickness 25.4 mm, Temperature 204 Â°C	@Thickness 1.00 in, Temperature 399 Â°F	
	769 MPa @Thickness 25.4 mm, Temperature 149 Â°C	112000 psi @Thickness 1.00 in, Temperature 300 Â°F	
	798 MPa @Thickness 25.4 mm, Temperature 93.0 Â°C	116000 psi @Thickness 1.00 in, Temperature 199 Â°F	
	832 MPa @Thickness 25.4 mm, Temperature 25.0 Â°C	121000 psi @Thickness 1.00 in, Temperature 77.0 Â°F	
Tensile Strength, Yield	252 MPa @Thickness 25.4 mm, Temperature 371 Â°C	36500 psi @Thickness 1.00 in, Temperature 700 Â°F	0.2% Offset
	256 MPa @Thickness 25.4 mm, Temperature 316 Â°C	37100 psi @Thickness 1.00 in, Temperature 601 Â°F	0.2% Offset
	256 MPa @Thickness 25.4 mm, Temperature 427 Â°C	37100 psi @Thickness 1.00 in, Temperature 801 Â°F	0.2% Offset
	273 MPa @Thickness 25.4 mm, Temperature 260 Â°C	39600 psi @Thickness 1.00 in, Temperature 500 Â°F	0.2% Offset
	289 MPa @Thickness 25.4 mm, Temperature 204 Â°C	41900 psi @Thickness 1.00 in, Temperature 399 Â°F	0.2% Offset
	311 MPa @Thickness 25.4 mm, Temperature 149 Â°C	45100 psi @Thickness 1.00 in, Temperature 300 Â°F	0.2% Offset
	347 MPa @Thickness 25.4 mm, Temperature 93.0 Â°C	50300 psi @Thickness 1.00 in, Temperature 199 Â°F	0.2% Offset
	385 MPa @Thickness 25.4 mm, Temperature 25.0 Â°C	55800 psi @Thickness 1.00 in, Temperature 77.0 Â°F	0.2% Offset
Elongation at Break	63 % @Thickness 25.4 mm, Temperature 25.0 Â°C	63 % @Thickness 1.00 in, Temperature 77.0 Â°F	

Mechanical Properties	Metric	English	Comments
	@Thickness 25.4 mm, Temperature 316 Â°C	@Thickness 1.00 in, Temperature 601 Â°F	
	72 % @Thickness 25.4 mm, Temperature 371 Â°C	72 % @Thickness 1.00 in, Temperature 700 Â°F	
	72.1 % @Thickness 25.4 mm, Temperature 204 Â°C	72.1 % @Thickness 1.00 in, Temperature 399 Â°F	
	72.7 % @Thickness 25.4 mm, Temperature 260 Â°C	72.7 % @Thickness 1.00 in, Temperature 500 Â°F	
	72.8 % @Thickness 25.4 mm, Temperature 149 Â°C	72.8 % @Thickness 1.00 in, Temperature 300 Â°F	
	73.6 % @Thickness 25.4 mm, Temperature 93.0 Â°C	73.6 % @Thickness 1.00 in, Temperature 199 Â°F	
	74.1 % @Thickness 25.4 mm, Temperature 427 Â°C	74.1 % @Thickness 1.00 in, Temperature 801 Â°F	
Modulus of Elasticity	188 GPa @Temperature 600 Â°C	27300 ksi @Temperature 1110 Â°F	Dynamic
	191 GPa @Temperature 500 Â°C	27700 ksi @Temperature 932 Â°F	Dynamic
	197 GPa @Temperature 400 Â°C	28600 ksi @Temperature 752 Â°F	Dynamic
	200 GPa @Temperature 300 Â°C	29000 ksi @Temperature 572 Â°F	Dynamic
	205 GPa @Temperature 200 Â°C	29700 ksi @Temperature 392 Â°F	Dynamic
	211 GPa @Temperature 100 Â°C	30600 ksi @Temperature 212 Â°F	Dynamic
	217 GPa @Temperature 25.0	31500 ksi	Dynamic

Mechanical Properties	Metric	English	Comments
	Â°C	@Temperature 77.0 Â°F	

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 Âµm/m-Â°C @Temperature 25.0 - 100 Â°C	6.39 Âµin/in-Â°F @Temperature 77.0 - 212 Â°F	
	11.9 Âµm/m-Â°C @Temperature 25.0 - 200 Â°C	6.61 Âµin/in-Â°F @Temperature 77.0 - 392 Â°F	
	12.2 Âµm/m-Â°C @Temperature 25.0 - 300 Â°C	6.78 Âµin/in-Â°F @Temperature 77.0 - 572 Â°F	
	12.5 Âµm/m-Â°C @Temperature 25.0 - 400 Â°C	6.94 Âµin/in-Â°F @Temperature 77.0 - 752 Â°F	
	12.7 Âµm/m-Â°C @Temperature 25.0 - 500 Â°C	7.06 Âµin/in-Â°F @Temperature 77.0 - 932 Â°F	
	12.7 Âµm/m-Â°C @Temperature 25.0 - 600 Â°C	7.06 Âµin/in-Â°F @Temperature 77.0 - 1110 Â°F	
Specific Heat Capacity	0.403 J/g-Â°C @Temperature 25.0 Â°C	0.0963 BTU/lb-Â°F @Temperature 77.0 Â°F	
	0.416 J/g-Â°C @Temperature 100 Â°C	0.0994 BTU/lb-Â°F @Temperature 212 Â°F	
	0.429 J/g-Â°C @Temperature 200 Â°C	0.103 BTU/lb-Â°F @Temperature 392 Â°F	
	0.439 J/g-Â°C @Temperature 300 Â°C	0.105 BTU/lb-Â°F @Temperature 572 Â°F	
	0.449 J/g-Â°C @Temperature 400 Â°C	0.107 BTU/lb-Â°F @Temperature 752 Â°F	
	0.457 J/g-Â°C @Temperature 600 Â°C	0.109 BTU/lb-Â°F @Temperature 1110 Â°F	
	0.461 J/g-Â°C	0.110 BTU/lb-Â°F	

Thermal Properties	Metric	English	Comments
	@Temperature 500 Â°C	@Temperature 932 Â°F	
Thermal Conductivity	9.30 W/m-K @Temperature 25.0 Â°C	64.5 BTU-in/hr-ftÂ²-Â°F @Temperature 77.0 Â°F	
	10.5 W/m-K @Temperature 100 Â°C	72.9 BTU-in/hr-ftÂ²-Â°F @Temperature 212 Â°F	
	11.9 W/m-K @Temperature 200 Â°C	82.6 BTU-in/hr-ftÂ²-Â°F @Temperature 392 Â°F	
	13.5 W/m-K @Temperature 300 Â°C	93.7 BTU-in/hr-ftÂ²-Â°F @Temperature 572 Â°F	
	14.9 W/m-K @Temperature 400 Â°C	103 BTU-in/hr-ftÂ²-Â°F @Temperature 752 Â°F	
	16.4 W/m-K @Temperature 500 Â°C	114 BTU-in/hr-ftÂ²-Â°F @Temperature 932 Â°F	
	17.5 W/m-K @Temperature 600 Â°C	121 BTU-in/hr-ftÂ²-Â°F @Temperature 1110 Â°F	
Maximum Service Temperature, Air	427 Â°C	800 Â°F	

Component Elements Properties	Metric	English	Comments
Aluminum, Al	<= 0.50 %	<= 0.50 %	
Carbon, C	<= 0.010 %	<= 0.010 %	
Chromium, Cr	15 %	15 %	
Iron, Fe	<= 1.25 %	<= 1.25 %	
Manganese, Mn	0.25 %	0.25 %	
Molybdenum, Mo	22 %	22 %	
Nickel, Ni	60.91 %	60.91 %	as balance
Silicon, Si	<= 0.080 %	<= 0.080 %	

Electrical Properties	Metric	English	Comments

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.000126 ohm-cm @Temperature 25.0 Â°C	0.000126 ohm-cm @Temperature 77.0 Â°F	
	0.000127 ohm-cm @Temperature 100 Â°C	0.000127 ohm-cm @Temperature 212 Â°F	
	0.000127 ohm-cm @Temperature 200 Â°C	0.000127 ohm-cm @Temperature 392 Â°F	
	0.000128 ohm-cm @Temperature 300 Â°C	0.000128 ohm-cm @Temperature 572 Â°F	
	0.000128 ohm-cm @Temperature 400 Â°C	0.000128 ohm-cm @Temperature 752 Â°F	
	0.000129 ohm-cm @Temperature 500 Â°C	0.000129 ohm-cm @Temperature 932 Â°F	
	0.000131 ohm-cm @Temperature 600 Â°C	0.000131 ohm-cm @Temperature 1110 Â°F	

Descriptive Properties	Value	Comments
Thermal Diffusivity	0.0264 cm^2/s	23Â°C
	0.0291 cm^2/s	at 100Â°C
	0.0319 cm^2/s	at 200Â°C
	0.0352 cm^2/s	at 300Â°C
	0.0382 cm^2/s	at 400Â°C
	0.0412 cm^2/s	at 500Â°C

Contact Songhan Plastic Technology Co.,Ltd.

Website : www.lookpolymers.com
Email : sales@lookpolymers.com
Tel : +86 021-51131842
Mobile : +86 13061808058
Skype : lookpolymers
Address : United North Road 215,Fengxian District, Shanghai City,China