Haynes Hastelloy® C-4 alloy, sheet, heat treated at 1066°C, rapid quenched

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

Material Notes:

Nickel-chromium-molybdenum alloy with outstanding high-temperature stability as evidenced by high ductility and corrosion resistance even after aging in the 1200 to 1900°F (649 to 1038°C) range. This alloy resists the formation of grain-boundary precipitates in the weld heat-affected zone, thus making it suitable for most chemical process applications in the as-welded condition. C-4 alloy also has excellent resistance to stress-corrosion cracking and to oxidizing atmospheres up to 1900°F (1038°C). HASTELLOY C-4 alloy has exceptional resistance to wide variety of chemical process environments. These include hot contaminated mineral acids, solvents, chlorine and chlorine contaminated media (organic and inorganic), dry chlorine, formic and acetic acids, acetic anhydride, and seawater and brine solutions. Laboratory precipitation studies on C-4 alloy indicate that the intermetallic precipitates (Mu phase) associated with other nickel alloys in the 1200 to 2000°F (649 to 1093°C) temperature range have not been detected. Fine intergranular M6C carbides can form but their damaging effect is minimal.HASTELLOY C-4 alloy can be forged, hot-upset, and impact extruded. Although the alloy tends to work-harden, it can be successfully deep-drawn, spun, press formed or punched. All of the common methods of welding can be used to weld HASTELLOY C-4 alloy, although the oxy-acetylene and submerged arc processes are not recommended when the fabricated item is intended for use in corrosion service. Special precautions should be taken to avoid excessive heat input.Wrought forms of HASTELLOY C-4 alloy are furnished in the solution heat-treated condition unless otherwise specified. C-4 alloy is solution heat-treated at 1950°F (1066°C) and rapid quenched.Data provided by the manufacturer, Haynes International, Inc.

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http://www.lookpolymers.com/polymer_Haynes-Hastelloy-C-4-alloy-sheet-heat-treated-at-1066C-rapid-quenched.php

Physical Properties	Metric	English	Comments
Density	8.64 g/cc	0.312 lb/in³	at RT

Mechanical Properties	Metric	English	Comments
Hardness, Brinell	155 @Thickness 1.70 mm	155 @Thickness 0.0669 in	Converted from Rockwell B hardness.
	159 @Thickness 3.20 mm	159 @Thickness 0.126 in	Converted from Rockwell B hardness.
Hardness, Knoop	172 @Thickness 1.70 mm	172 @Thickness 0.0669 in	Converted from Rockwell B hardness.
	176 @Thickness 3.20 mm	176 @Thickness 0.126 in	Converted from Rockwell B hardness.
Hardness, Rockwell B	90 @Thickness 1.70 mm	90 @Thickness 0.0669 in	
	92	92	

Mechanical Properties	Metric	English	Comments
	91 @Thickness 4.00 mm, Temperature 204 °C	91 @Thickness 0.157 in, Temperature 399 °F	
Hardness, Vickers	191 @Thickness 1.70 mm	191 @Thickness 0.0669 in	Converted from Rockwell B hardness.
	201 @Thickness 3.20 mm	201 @Thickness 0.126 in	Converted from Rockwell B hardness.
Tensile Strength, Ultimate	476 MPa @Thickness 3.20 mm, Temperature 760 °C	69000 psi @Thickness 0.126 in, Temperature 1400 °F	
	571 MPa @Thickness 3.20 mm, Temperature 649 °C	82800 psi @Thickness 0.126 in, Temperature 1200 °F	
	644 MPa @Thickness 3.20 mm, Temperature 427 °C	93400 psi @Thickness 0.126 in, Temperature 801 °F	
	645 MPa @Thickness 3.20 mm, Temperature 538 °C	93500 psi @Thickness 0.126 in, Temperature 1000 °F	
	656 MPa @Thickness 1.70 mm, Temperature 427 °C	95100 psi @Thickness 0.0669 in, Temperature 801 °F	
	656 MPa @Thickness 4.00 mm, Temperature 427 °C	95100 psi @Thickness 0.157 in, Temperature 801 °F	
	657 MPa @Thickness 4.00 mm, Temperature 316 °C	95300 psi @Thickness 0.157 in, Temperature 601 °F	
	672 MPa @Thickness 3.20 mm, Temperature 316 °C	97500 psi @Thickness 0.126 in, Temperature 601 °F	
	675 MPa @Thickness 1.70 mm, Temperature 316 °C	97900 psi @Thickness 0.0669 in, Temperature 601 °F	
	678 MPa @Thickness 3.20 mm,	98300 psi @Thickness 0.126 in,	

Mechanical Properties	Temperature 204 °C Metric	Temperature 399 °F English	Comments
	689 MPa @Thickness 4.00 mm, Temperature 204 °C	99900 psi @Thickness 0.157 in, Temperature 399 °F	
	706 MPa @Thickness 1.70 mm, Temperature 204 °C	102000 psi @Thickness 0.0669 in, Temperature 399 °F	
	768 MPa @Thickness 1.70 mm, Temperature 20.0 °C	111000 psi @Thickness 0.0669 in, Temperature 68.0 °F	
	783 MPa @Thickness 4.00 mm, Temperature 20.0 °C	114000 psi @Thickness 0.157 in, Temperature 68.0 °F	
	801 MPa @Thickness 3.20 mm, Temperature 20.0 °C	116000 psi @Thickness 0.126 in, Temperature 68.0 °F	
Tensile Strength, Yield	249 MPa @Thickness 4.00 mm, Temperature 316 °C	36100 psi @Thickness 0.157 in, Temperature 601 °F	0.2% offset
	250 MPa @Thickness 4.00 mm, Temperature 427 °C	36300 psi @Thickness 0.157 in, Temperature 801 °F	0.2% offset
	260 MPa @Thickness 3.20 mm, Temperature 760 °C	37700 psi @Thickness 0.126 in, Temperature 1400 °F	0.2% offset
	275 MPa @Thickness 4.00 mm, Temperature 204 °C	39900 psi @Thickness 0.157 in, Temperature 399 °F	0.2% offset
	291 MPa @Thickness 3.20 mm, Temperature 649 °C	42200 psi @Thickness 0.126 in, Temperature 1200 °F	0.2% offset
	299 MPa @Thickness 3.20 mm, Temperature 538 °C	43400 psi @Thickness 0.126 in, Temperature 1000 °F	0.2% offset
	303 MPa @Thickness 3.20 mm, Temperature 316 °C	43900 psi @Thickness 0.126 in, Temperature 601 °F	0.2% offset
	303 MPa	43900 psi	

Mechanical Properties	Metric	English	Comments
	@Thickness 3.20 mm, Temperature 427 °C	@Thickness 0.126 in, Temperature 801 °F	
	320 MPa @Thickness 1.70 mm, Temperature 427 °C	46400 psi @Thickness 0.0669 in, Temperature 801 °F	0.2% offset
	320 MPa @Thickness 3.20 mm, Temperature 204 °C	46400 psi @Thickness 0.126 in, Temperature 399 °F	0.2% offset
	365 MPa @Thickness 4.00 mm, Temperature 20.0 °C	52900 psi @Thickness 0.157 in, Temperature 68.0 °F	0.2% offset
	371 MPa @Thickness 1.70 mm, Temperature 316 °C	53800 psi @Thickness 0.0669 in, Temperature 601 °F	0.2% offset
	403 MPa @Thickness 1.70 mm, Temperature 204 °C	58500 psi @Thickness 0.0669 in, Temperature 399 °F	0.2% offset
	416 MPa @Thickness 1.70 mm, Temperature 20.0 °C	60300 psi @Thickness 0.0669 in, Temperature 68.0 °F	0.2% offset
	421 MPa @Thickness 3.20 mm, Temperature 20.0 °C	61100 psi @Thickness 0.126 in, Temperature 68.0 °F	0.2% offset
Elongation at Break	44 % @Thickness 3.20 mm, Temperature 760 °C	44 % @Thickness 0.126 in, Temperature 1400 °F	in 50.8 mm
	49 % @Thickness 1.70 mm, Temperature 204 °C	49 % @Thickness 0.0669 in, Temperature 399 °F	in 50.8 mm
	50 % @Thickness 3.20 mm, Temperature 649 °C	50 % @Thickness 0.126 in, Temperature 1200 °F	in 50.8 mm
	52 % @Thickness 1.70 mm, Temperature 20.0 °C	52 % @Thickness 0.0669 in, Temperature 68.0 °F	in 50.8 mm
	52 % @Thickness 1.70 mm,	52 % @Thickness 0.0669 in,	in 50.8 mm

Mechanical Properties	Metric	English	Comments
	Temperature 316 °C 54 %	Temperature 601 °F 54 %	
	@Thickness 3.20 mm, Temperature 20.0 °C	@Thickness 0.126 in, Temperature 68.0 °F	in 50.8 mm
	54 % @Thickness 3.20 mm, Temperature 204 °C	54 % @Thickness 0.126 in, Temperature 399 °F	in 50.8 mm
	55 % @Thickness 4.00 mm, Temperature 20.0 °C	55 % @Thickness 0.157 in, Temperature 68.0 °F	in 50.8 mm
	55 % @Thickness 3.20 mm, Temperature 538 °C	55 % @Thickness 0.126 in, Temperature 1000 °F	in 50.8 mm
	55 % @Thickness 4.00 mm, Temperature 204 °C	55 % @Thickness 0.157 in, Temperature 399 °F	in 50.8 mm
	59 % @Thickness 3.20 mm, Temperature 316 °C	59 % @Thickness 0.126 in, Temperature 601 °F	in 50.8 mm
	61 % @Thickness 4.00 mm, Temperature 316 °C	61 % @Thickness 0.157 in, Temperature 601 °F	in 50.8 mm
	62 % @Thickness 3.20 mm, Temperature 427 °C	62 % @Thickness 0.126 in, Temperature 801 °F	in 50.8 mm
	64 % @Thickness 1.70 mm, Temperature 427 °C	64 % @Thickness 0.0669 in, Temperature 801 °F	in 50.8 mm
	68 % @Thickness 4.00 mm, Temperature 427 °C	68 % @Thickness 0.157 in, Temperature 801 °F	in 50.8 mm
Modulus of Elasticity	211 GPa	30600 ksi	RT
	141 GPa @Temperature 982 °C	20500 ksi @Temperature 1800 °F	
	152 GPa @Temperature 871 °C	22000 ksi @Temperature 1600 °F	
	162 GPa	23500 ksi	

Mechanical Properties	Metric	English	Comments
	@Temperature 760 °C	@Temperature 1400 °F	
	171 GPa @Temperature 649 °C	24800 ksi @Temperature 1200 °F	
	179 GPa @Temperature 538 °C	26000 ksi @Temperature 1000 °F	
	187 GPa @Temperature 427 °C	27100 ksi @Temperature 801 °F	
	194 GPa @Temperature 316 °C	28100 ksi @Temperature 601 °F	
	201 GPa @Temperature 204 °C	29200 ksi @Temperature 399 °F	
	207 GPa @Temperature 93.0 °C	30000 ksi @Temperature 199 °F	

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.000125 ohm-cm @Temperature 23.0 °C	0.000125 ohm-cm @Temperature 73.4 °F	
	0.000125 ohm-cm @Temperature 100 °C	0.000125 ohm-cm @Temperature 212 °F	
	0.000126 ohm-cm @Temperature 200 °C	0.000126 ohm-cm @Temperature 392 °F	
	0.000127 ohm-cm @Temperature 300 °C	0.000127 ohm-cm @Temperature 572 °F	
	0.000128 ohm-cm @Temperature 400 °C	0.000128 ohm-cm @Temperature 752 °F	
	0.000129 ohm-cm @Temperature 500 °C	0.000129 ohm-cm @Temperature 932 °F	

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