

Haynes Hastelloy® S alloy, flat products, solution heat-treated at 538°C (1000°F), aged 4000 hours

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

Material Notes:

Nickel-based, high temperature alloy. Excellent thermal stability, low thermal expansion, excellent oxidation resistance to 1093°C, good high temperature and thermal fatigue strength. Applications include seal rings in gas turbine engines, and severe cyclical heating conditions where it retains strength, ductility, and integrity. Data provided by the manufacturer, Haynes International, Inc.

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http://www.lookpolymers.com/polymer_Haynes-Hastelloy-S-alloy-flat-products-solution-heat-treated-at-538C-1000F-aged-4000-hours.php

Physical Properties	Metric	English	Comments
Density	8.75 g/cc	0.316 lb/in ³	

Mechanical Properties	Metric	English	Comments
Hardness, Rockwell A	63	63	
	@Thickness 12.7 mm	@Thickness 0.500 in	
	66	66	
	@Thickness 1.45 mm	@Thickness 0.0571 in	
Tensile Strength, Ultimate	1207 MPa	175100 psi	
	@Thickness 12.7 mm	@Thickness 0.500 in	
	1253 MPa	181700 psi	
	@Thickness 1.45 mm	@Thickness 0.0571 in	
Tensile Strength, Yield	707 MPa	103000 psi	
	@Strain 0.200 %, Thickness 12.7 mm	@Strain 0.200 %, Thickness 0.500 in	
	741 MPa	107000 psi	
	@Strain 0.200 %, Thickness 1.45 mm	@Strain 0.200 %, Thickness 0.0571 in	
Elongation at Break	41 %	41 %	in 50.8 mm
	@Thickness 1.45 mm	@Thickness 0.0571 in	
	44 %	44 %	in 50.8 mm
	@Thickness 12.7 mm	@Thickness 0.500 in	
Modulus of Elasticity	132 GPa	19100 ksi	
	@Temperature 1093	@Temperature 1999	Heat treated at 1066°C, air cooled

Mechanical Properties	°C Metric	°F English	Comments
	151 GPa @Temperature 927 °C	21900 ksi @Temperature 1700 °F	Heat treated at 1066°C, air cooled
	161 GPa @Temperature 813 °C	23400 ksi @Temperature 1500 °F	Heat treated at 1066°C, air cooled
	166 GPa @Temperature 760 °C	24100 ksi @Temperature 1400 °F	Heat treated at 1066°C, air cooled
	174 GPa @Temperature 649 °C	25200 ksi @Temperature 1200 °F	Heat treated at 1066°C, air cooled
	182 GPa @Temperature 538 °C	26400 ksi @Temperature 1000 °F	Heat treated at 1066°C, air cooled
	194 GPa @Temperature 357 °C	28100 ksi @Temperature 675 °F	Heat treated at 1066°C, air cooled
	212 GPa @Temperature 24.0 °C	30700 ksi @Temperature 75.2 °F	
Charpy Impact	104 J @Temperature 427 °C	76.7 ft-lb @Temperature 801 °F	V Notch; plate

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 µm/m-°C @Temperature 20.0 - 93.0 °C	6.39 µin/in-°F @Temperature 68.0 - 199 °F	
	12.2 µm/m-°C @Temperature 20.0 - 204 °C	6.78 µin/in-°F @Temperature 68.0 - 399 °F	
	12.8 µm/m-°C @Temperature 20.0 - 316 °C	7.11 µin/in-°F @Temperature 68.0 - 601 °F	
	13.1 µm/m-°C @Temperature 20.0 - 427 °C	7.28 µin/in-°F @Temperature 68.0 - 801 °F	

Thermal Properties	13.3 Åµm/m-Å°C Metric	7.39 Åµin/in-Å°F English	Comments
	@Temperature 20.0 - 538 Å°C	@Temperature 68.0 - 1000 Å°F	
	14.4 Åµm/m-Å°C	8.00 Åµin/in-Å°F	
	@Temperature 20.0 - 760 Å°C	@Temperature 68.0 - 1400 Å°F	
	14.9 Åµm/m-Å°C	8.28 Åµin/in-Å°F	
	@Temperature 20.0 - 871 Å°C	@Temperature 68.0 - 1600 Å°F	
	15.5 Åµm/m-Å°C	8.61 Åµin/in-Å°F	
	@Temperature 20.0 - 982 Å°C	@Temperature 68.0 - 1800 Å°F	
	16.0 Åµm/m-Å°C	8.89 Åµin/in-Å°F	
	@Temperature 20.0 - 1093 Å°C	@Temperature 68.0 - 1999 Å°F	
Specific Heat Capacity	0.398 J/g-Å°C	0.0951 BTU/lb-Å°F	
	@Temperature 0.000 Å°C	@Temperature 32.0 Å°F	
	0.414 J/g-Å°C	0.0989 BTU/lb-Å°F	
	@Temperature 50.0 Å°C	@Temperature 122 Å°F	
	0.440 J/g-Å°C	0.105 BTU/lb-Å°F	
	@Temperature 150 Å°C	@Temperature 302 Å°F	
	0.456 J/g-Å°C	0.109 BTU/lb-Å°F	
	@Temperature 250 Å°C	@Temperature 482 Å°F	
	0.473 J/g-Å°C	0.113 BTU/lb-Å°F	
	@Temperature 350 Å°C	@Temperature 662 Å°F	
	0.481 J/g-Å°C	0.115 BTU/lb-Å°F	
	@Temperature 450 Å°C	@Temperature 842 Å°F	
	0.494 J/g-Å°C	0.118 BTU/lb-Å°F	
	@Temperature 550 Å°C	@Temperature 1020 Å°F	
	0.502 J/g-Å°C	0.120 BTU/lb-Å°F	
	@Temperature 650 Å°C	@Temperature 1200 Å°F	
	0.590 J/g-Å°C	0.141 BTU/lb-Å°F	

Thermal Properties	Metric	English	Comments
	@Temperature 800 Â°C	@Temperature 1470 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@Temperature 850 Â°C	@Temperature 1560 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@Temperature 900 Â°C	@Temperature 1650 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@Temperature 700 Â°C	@Temperature 1290 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@Temperature 750 Â°C	@Temperature 1380 Â°F	
	0.598 J/g-Â°C	0.143 BTU/lb-Â°F	
	@Temperature 950 Â°C	@Temperature 1740 Â°F	
	0.598 J/g-Â°C	0.143 BTU/lb-Â°F	
	@Temperature 1000 Â°C	@Temperature 1830 Â°F	
	0.598 J/g-Â°C	0.143 BTU/lb-Â°F	
	@Temperature 1050 Â°C	@Temperature 1920 Â°F	
	0.603 J/g-Â°C	0.144 BTU/lb-Â°F	
	@Temperature 1100 Â°C	@Temperature 2010 Â°F	
Thermal Conductivity	14.0 W/m-K	97.2 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	16.1 W/m-K	112 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 300 Â°C	@Temperature 572 Â°F	
	17.9 W/m-K	124 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 400 Â°C	@Temperature 752 Â°F	
	19.5 W/m-K	135 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 500 Â°C	@Temperature 932 Â°F	
	21.0 W/m-K	146 BTU-in/hr-ftÂ²-Â°F	

Thermal Properties	Metric	English	Comments
	26.1 W/m-K @Temperature 600 °C	181 BTU-in/hr-ft ² -°F @Temperature 1110 °F	
	26.1 W/m-K @Temperature 700 °C	181 BTU-in/hr-ft ² -°F @Temperature 1290 °F	
	26.1 W/m-K @Temperature 800 °C	181 BTU-in/hr-ft ² -°F @Temperature 1470 °F	
	26.1 W/m-K @Temperature 900 °C	181 BTU-in/hr-ft ² -°F @Temperature 1650 °F	
	27.1 W/m-K @Temperature 950 °C	188 BTU-in/hr-ft ² -°F @Temperature 1740 °F	
	28.0 W/m-K @Temperature 1000 °C	194 BTU-in/hr-ft ² -°F @Temperature 1830 °F	
Melting Point	1335 - 1380 °C	2435 - 2520 °F	
Solidus	1335 °C	2435 °F	
Liquidus	1380 °C	2520 °F	
Maximum Service Temperature, Air	1093 °C	1999 °F	

Component Elements Properties	Metric	English	Comments
Aluminum, Al	0.10 - 0.50 %	0.10 - 0.50 %	
Boron, B	<= 0.015 %	<= 0.015 %	
Carbon, C	<= 0.020 %	<= 0.020 %	
Chromium, Cr	14.5 - 17 %	14.5 - 17 %	
Cobalt, Co	<= 2.0 %	<= 2.0 %	
Copper, Cu	<= 0.35 %	<= 0.35 %	
Iron, Fe	<= 3.0 %	<= 3.0 %	
Lanthanum, La	0.010 - 0.10 %	0.010 - 0.10 %	
Manganese, Mn	0.30 - 1.0 %	0.30 - 1.0 %	
Molybdenum, Mo	14 - 16.5 %	14 - 16.5 %	

Component Elements Properties	Metric	English	Comments
Electrical Properties			
Electrical Resistivity	0.000128 ohm-cm @Temperature 25.0 Â°C	0.000128 ohm-cm @Temperature 77.0 Â°F	specimen aged 16000 hours at 650Â°C (1200Â°F)

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