

Carpenter Thermo-Span® Fe-Co-Ni Superalloy

Category : Metal , Superalloy , Iron Base

Material Notes:

Data provided by Carpenter Technology Corporation. Thermo-Span® alloy is a precipitation hardenable superalloy which exhibits a low coefficient of thermal expansion over a broad temperature range, high tensile and rupture strengths, and good thermal fatigue resistance. This alloy offers a significant improvement in environmental resistance over Pyromet® alloys CTX-1, CTX-3, AND CTX-909 due to the addition of chromium. the alloy also possesses an excellent combination of tensile properties and stress rupture strength in the recrystallized condition with the use of common solution and age hardening treatments. Unlike the CTX-family of alloys, the use of specific braze-cycle age hardening treatments is not required for Thermo-Span alloy due to the higher solution treating temperature. Thermo-Span alloy should be considered for use in all applications for which the current low expansion superalloys are suited. These include compressor and exhaust casings, seals and other gas turbine components. Additional high temperature applications where moderate oxidation resistance is required are feasible with Thermo-Span alloy. This alloy should also be considered for use in applications requiring resistance to thermal fatigue. Thermo-Span® is a registered trademark of Carpenter Technology Corporation.

Order this product through the following link:

http://www.lookpolymers.com/polymer_Carpenter-Thermo-Span-Fe-Co-Ni-Superalloy.php

Physical Properties	Metric	English	Comments
Density	8.23 g/cc	0.297 lb/in ³	

Mechanical Properties	Metric	English	Comments
Tensile Strength, Ultimate	1227 MPa	178000 psi	
	579 MPa	84000 psi	
	@Temperature 760 °C	@Temperature 1400 °F	
	678 MPa	98300 psi	
	@Temperature 732 °C	@Temperature 1350 °F	
	800 MPa	116000 psi	
	@Temperature 705 °C	@Temperature 1300 °F	
	904 MPa	131000 psi	
	@Temperature 677 °C	@Temperature 1250 °F	
	1055 MPa	153000 psi	
	@Temperature 649 °C	@Temperature 1200 °F	
	1089 MPa	157900 psi	
	@Temperature 538 °C	@Temperature 1000 °F	
	1175 MPa	170400 psi	

Mechanical Properties	@Temperature 260 °C Metric	@Temperature 500 °F English	Comments
Tensile Strength, Yield	876 MPa	127000 psi	
	@Strain 0.200 %	@Strain 0.200 %	
	496 MPa	71900 psi	
	@Strain 0.200 %, Temperature 760 °C	@Strain 0.200 %, Temperature 1400 °F	
	579 MPa	84000 psi	
	@Strain 0.200 %, Temperature 732 °C	@Strain 0.200 %, Temperature 1350 °F	
	662 MPa	96000 psi	
	@Strain 0.200 %, Temperature 705 °C	@Strain 0.200 %, Temperature 1300 °F	
	745 MPa	108000 psi	
	@Strain 0.200 %, Temperature 677 °C	@Strain 0.200 %, Temperature 1250 °F	
	807 MPa	117000 psi	
	@Strain 0.200 %, Temperature 538 °C	@Strain 0.200 %, Temperature 1000 °F	
	814 MPa	118000 psi	
	@Strain 0.200 %, Temperature 649 °C	@Strain 0.200 %, Temperature 1200 °F	
	841 MPa	122000 psi	
	@Strain 0.200 %, Temperature 260 °C	@Strain 0.200 %, Temperature 500 °F	
Elongation at Break	16 %	16 %	In 4D
	15 %	15 %	In 4D
	@Temperature 538 °C	@Temperature 1000 °F	
	16 %	16 %	In 4D
	@Temperature 260 °C	@Temperature 500 °F	
	19 %	19 %	In 4D
	@Temperature 677 °C	@Temperature 1250 °F	
	20 %	20 %	In 4D
	@Temperature 649 °C	@Temperature 1200 °F	
	24 %	24 %	In 4D
	@Temperature 705 °C	@Temperature 1300 °F	

Mechanical Properties	Metric	English	Comments
	@Temperature 732 °C	@Temperature 1350 °F	In 4D
	30 %	30 %	In 4D
	@Temperature 760 °C	@Temperature 1400 °F	
Reduction of Area	32 %	32 %	
	32 %	32 %	
	@Temperature 732 °C	@Temperature 1350 °F	
	34 %	34 %	
	@Temperature 260 °C	@Temperature 500 °F	
	35 %	35 %	
	@Temperature 538 °C	@Temperature 1000 °F	
	35 %	35 %	
	@Temperature 677 °C	@Temperature 1250 °F	
	46 %	46 %	
	@Temperature 705 °C	@Temperature 1300 °F	
	49 %	49 %	
	@Temperature 649 °C	@Temperature 1200 °F	
	67 %	67 %	
	@Temperature 760 °C	@Temperature 1400 °F	
Modulus of Elasticity	145 GPa	21000 ksi	
	@Temperature 982 °C	@Temperature 1800 °F	
	165 GPa	23900 ksi	
	@Temperature 649 °C	@Temperature 1200 °F	
	189 GPa	27400 ksi	
	@Temperature 23.0 °C	@Temperature 73.4 °F	

Thermal Properties	Metric	English	Comments
CTE, linear	7.70 µm/m-°C	4.28 µin/in-°F	
	@Temperature 25.0 - 204 °C	@Temperature 77.0 - 399 °F	
	8.30 µm/m-°C	4.61 µin/in-°F	
	@Temperature 25.0 -	@Temperature 77.0 -	

Thermal Properties	316 °C Metric	601 °F English	Comments
	11.0 $\mu\text{m}/\text{m}\cdot^{\circ}\text{C}$	6.11 $\mu\text{in}/\text{in}\cdot^{\circ}\text{F}$	
	@Temperature 25.0 - 538 °C	@Temperature 77.0 - 1000 °F	
Specific Heat Capacity	0.463 J/g-°C	0.111 BTU/lb-°F	
	@Temperature 23.0 °C	@Temperature 73.4 °F	
	0.518 J/g-°C	0.124 BTU/lb-°F	
	@Temperature 202 °C	@Temperature 396 °F	
	0.549 J/g-°C	0.131 BTU/lb-°F	
	@Temperature 652 °C	@Temperature 1210 °F	
Thermal Conductivity	11.3 W/m-K	78.4 BTU-in/hr-ft ² -°F	
	@Temperature 23.0 °C	@Temperature 73.4 °F	
	15.0 W/m-K	104 BTU-in/hr-ft ² -°F	
	@Temperature 202 °C	@Temperature 396 °F	
	22.1 W/m-K	153 BTU-in/hr-ft ² -°F	
	@Temperature 652 °C	@Temperature 1210 °F	

Component Elements Properties	Metric	English	Comments
Aluminum, Al	0.30 - 0.60 %	0.30 - 0.60 %	
Boron, B	<= 0.010 %	<= 0.010 %	
Carbon, C	<= 0.050 %	<= 0.050 %	
Chromium, Cr	5.0 - 6.0 %	5.0 - 6.0 %	
Cobalt, Co	28 - 30 %	28 - 30 %	
Copper, Cu	<= 0.50 %	<= 0.50 %	
Iron, Fe	34 %	34 %	as remainder
Manganese, Mn	<= 0.50 %	<= 0.50 %	
Nickel, Ni	23.5 - 25.5 %	23.5 - 25.5 %	
Niobium, Nb (Columbium, Cb)	4.5 - 5.2 %	4.5 - 5.2 %	
Phosphorous, P	<= 0.015 %	<= 0.015 %	
Silicon, Si	0.20 - 0.30 %	0.20 - 0.30 %	
Sulfur, S	<= 0.015 %	<= 0.015 %	

Component Elements Properties	Metric	English	Comments
Titanium, Ti	0.70-1.0%	0.70-1.0%	

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