CORROSION MATERIALS

"Your Corrosion Alloy Specialist"

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Alloy F255

UNS S32550/ W.Nr. 1.4507

Alloy F255 (UNS S32550 / W.Nr. 1.4507) is a highly alloyed, superduplex (ferrite-austenite) solid solution strengthened alloy, which provides high strength and wear resistance while offering superior corrosion resistance compared to 316 stainless steel. This combination makes Alloy F255 ideal for demanding applications in a number of different industries such as Offshore Oil & Gas, Pulp & Paper, Nuclear, Marine, Chemical Processing and Flue Gas Desulfurization.

Operating temperatures should be considered when selecting Alloy 255 as secondary phases could form within higher temperature ranges. If the alloy is allowed to soak between the temperatures of 1000°F and 1800°F, carbides ($M_{23}C_6$), nitrides (M_2N) and sigma phase can form. At temperatures approaching 900°F, alpha prime can form. The maximum continuous operating temperature according to ASME Boiler and Pressure Vessel Code, Section VIII is 500°F.

Resistance to Corrosion

Compared to typical austenitic alloys such as 304, 316 and 317 stainless steels, Alloy F255 displays superior corrosion resistance in most media. Also, Alloy F255 typically out performs duplex alloy 2205. Alloy F255 performs well in sulfuric, phosphoric, nitric and shows excellent resistance to organic acids such as acetic and formic acid. Highly reducing media should be avoided.

Pitting resistance equivalent numbers (PREN) are typically used to compare the pitting resistance of various alloys. This number can be calculated from a number of different equations, which are based on specific alloying elements that contribute to the alloys pitting resistance. For duplex stainless steels the equation typically used to calculate the PREN is as shown below. A word of caution, the PREN is not a guarantee of the corrosion performance of any alloy and should only be used a s guide to help the user select potential alloys for specific use.

PREN = %Cr + 3.3 x %Mo + 16 x N

Fabrication and Heat Treatment

Hot and cold forming can be performed on Alloy F255 via traditional methods keeping in mind that the alloy is higher strength compared to 316 stainless steel. Hot working the alloy should be between the temperatures of 1800°F and 2100°F followed by an annealing heat treatment at 1950°F and water quench. Cold working the alloy to induce more than 10% deformation will require a similar heat treatment. For forming above 20% deformation, intermediate heat treatments should be performed.

Machining Alloy F255 can be performed using the same methods as traditional stainless steels. Carbide tipped tools are preferred. Stress relieving by heating to 675°F briefly, followed by rapid cooling can be performed on heavily machined components.

Mechanical Properties

Annealed Material

Product Form	Tensile Minimum[1]	Yield Minimum[1] (0.2% offset)	Elongation Minimum[1]	Hardness Maximum[1]
Bar	110 ksi	80 ksi	15%	297 BHN
Sheet/Plate	110 ksi	80 ksi	15%	302 BHN

1. According to applicable ASTM specifications.

Physical Properties

Density@ Room Temp.	0.282 lb/in.^{3}
Poisson's Ratio	0.32
Young's Modulus	28.9 X 10^3 ksi
Torsional Modulus	10.9 X 10^3 ksi
Specific Heat @ 68°F	0.114 Btu/lb•°F
Specific Heat @ 212°F	0.120 Btu/lb•°F
Specific Heat @ 392°F	0.127 Btu/lb•°F
Coefficient of Thermal Expansion	
68°F to 212°F	6.17 x 10^{-6} in./in.•°F
68°F to 392°F	6.39 x 10^{-6} in./in.•°F
68°F to 572°F	6.67 x 10^{-6} in./in.•°F
Thermal Conductivity @ 68°F	98.5 Btu•in./ft^2•h•°F
Thermal Conductivity @ 212°F	113.0 Btu•in./ft^2•h•°F
Thermal Conductivity @ 392°F	127.6 Btu•in./ft^2•h•°F

Charpy Impact Properties

Test Temperature	Ft-lbs.	Joules
68°F	184	250
-51°F	111	150

Chemical Composition

Cr .....24.0 to 27.0	Cu .....1.5 to 2.5	Mn.....1.50 Max.	C.....0.04 Max.
Ni .....4.5 to 6.5	N.....0.10 to 0.25	P.....0.04 Max.	Fe .....Balance
Mo .....2.9 to 3.9	Si ..... 1.00 Max.	S .....0.030 Max.	

Welding can be performed by TIG, MIG or SMAW and should be performed on material in the annealed condition. Pre heat treatment is not necessary but it is important to carefully clean the surfaces being welded. If pickling is the desired method for cleaning the surface, a solution with the following composition can be used.

15% HNO_3 + 2% HF (volume by volume) at a minimum temperature of 55°F

Post weld heat treatment is not necessary but preferred when welding heavy sections to optimize corrosion resistance.

Aqueous Corrosion Data

Media	Common Name	Test Temp. °F	Corrosion Rate (mpy)
10% $C_2H_4O_2$	Acetic Acid	Boiling	0.2
50% $C_2H_4O_2$	Acetic Acid	Boiling	0.0
$C_6H_8O_7$	Citric Acid	Boiling	0.0
20% CH_2O_2	Formic Acid	Boiling	0.4
40% CH_2O_2	Formic Acid	Boiling	0.4
60% CH_2O_2	Formic Acid	Boiling	0.1
88% CH_2O_2	Formic Acid	Boiling	18
1% HCl	Hydrochloric Acid	77	0.0
2.5% HCl	Hydrochloric Acid	77	0.0
10% HNO_3	Nitric Acid	Boiling	1.9
65% HNO_3	Nitric Acid	Boiling	8.0
10% H_3PO_3	Phosphoric Acid	150	0.0
30% H_3PO_3	Phosphoric Acid	150	0.1
55% H_3PO_3	Phosphoric Acid	150	0.0
85% H_3PO_3	Phosphoric Acid	150	0.1
3% NaCl	Sodium Chloride	Boiling	0.4
50% NaOH	Sodium Hydroxide	Boiling	1.8
5% H_2SO_4	Sulfuric Acid	Boiling	12
10% H_2SO_4	Sulfuric Acid	Boiling	40
20% H_2SO_4	Sulfuric Acid	150	0.0
ASTM Synthetic Sea Water		95	0.0
ASTM Synthetic Sea Water		122	0.1
ASTM Synthetic Sea Water		194	0.0

Applicable Specifications

Alloy F255 - Form	ASTM	ASME	European Standard
Bar	A479	SA479	EN 10204-3.1
Sheet[1]	A240, A480[2]	SA240	EN 10204-3.1
Plate	A240, A480[2]	SA240	EN 10204-3.1
Seamless & Welded Tube	A789	SA789	EN 10204-3.1
Seamless & Welded Pipe	A790	SA790	EN 10204-3.1

1. Grain Size per ASTM E112. **2.** Flatness requirements only.

Please contact Corrosion Materials for a complete list of available items from inventory.

In-house machine and weld facilities help insure that the most common items will be in stock. Items not in stock can be fabricated in a short period of time either in-house or through our extensive, approved subcontractor and supplier network.

We also supply a complete range of items in the following alloys; Alloy C276, B2, B-3®, F-255, Alloy 22, 625, 200/201, Alloy 400, 405 and 600. Bar products are also available in K500, Alloy 800H/HT®, and Alloy 6B as well as various Ti grades.

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