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ALLOY C-276
UNS N10276 / W.Nr. 2.4819

Description
Alloy C-276 is a solid solution strengthened nickel-molybdenum-chromium alloy with a small amount of tungsten. Alloy C-276 exhibits excellent corrosion resistance in a variety of harsh environments and media. Like many other nickel alloys, it is ductile, easily formed and welded. This alloy is used in most industrial settings where aggressive chemical environments are present and other alloys have failed.

Industries and Applications
Alloy C-276 is frequently used in many industries, including chemical and petrochemical processing, oil and gas, power generation, pharmaceutical, pulp and paper production and waste water treatment. End use applications include stack liners, ducts, dampers, scrubbers, stack gas reheaters, heat exchangers, reaction vessels, evaporators, transfer piping and many other highly corrosive applications.

Resistance to Corrosion
Alloy C-276 is one of the most universally corrosion resistant alloys available today. It is used in a variety of environments ranging from moderately oxidizing to strong reducing conditions. Alloy C-276 has exceptional resistance to sulfuric acid, hydrochloric acid, formic acid, acetic acid, chlorides, solvents, wet chloride gas, hypochlorite and chlorine solutions. Alloy C-276 has excellent resistance to phosphoric acid at all temperatures below boiling and concentrations lower than 65%. The limiting factor when dealing with strong oxidizing environments is the low chromium content, which means hot concentrated nitric acid environments are not desirable.

Alloy C-276 has superior resistance to pitting, stress corrosion cracking and oxidizing atmospheres. Alloy C-276 also exhibits resistance to corrosion by seawater in crevice conditions, which can induce aggressive attack in other commonly used materials.

Fabrication and Heat Treatment
Alloy C-276 can be formed using various cold and hot working processes. Like other nickel alloys, alloy C-276 work hardens quickly, though it can be cold formed using aggressive methods like deep drawing, press forming and punching. Hot forming should be performed within a temperature range between 1600°F and 2250°F (870°C and 1230°C) with heavier sections being heated to a minimum temperature of 2000°F before forming. Annealing of the material after working is advised and should be performed at a temperature between 2050°F and 2150°F, followed by a rapid quench in a protective atmosphere or agitated reducing quench bath. To obtain a reducing quench bath, add 2% (by volume) of either ethyl or propyl alcohol to water.

The information contained in this technical data sheet is intended to be used as a guide and may be revised at any time without prior notice. The information is believed to be reliable and accurate, however Corrosion Materials does not make any warranty or assume any legal liability with respect to the accuracy, completeness or usefulness of the information.

Chemical Composition (%)

(Ni) Nickel	Remainder
(Mo) Molybdenum	15.0 to 17.0
(Cr) Chromium	14.5 to 16.5
(Fe) Iron	4.0 to 7.0
(W) Tungsten	3.0 to 4.5
(Co) Cobalt	2.5 max
(Mn) Manganese	1.0 max
(V) Vanadium	0.35 max
(Si) Silicon	0.08 max
(P) Phosphorus	0.04 max
(S) Sulfur	0.03 max
(C) Carbon	0.010 max

Mechanical Properties

Product Form	Tensile (min. ksi)	0.2% Yield (min. ksi)	Elong. (min. %)	Hardness* HRB
Bar	100	41	40	85-100
Plate & Sheet	100	41	40	85-100
Pipe & Tube	100	41	40	85-100

All properties in this table are for material in the solution annealed condition and are from the governing ASTM specification.

*Hardness is shown for information purpose only.

Physical Properties

Density @ Room Temp.	0.321 lb/in.^{3}
Elastic Modulus @ Room Temp.	29.8 x 10^3 ksi
Melting Range	2415°F to 2500°F
Specific Heat @ Room Temp.	0.102 Btu/(lb•°F)
Electrical Resistivity @ Room Temp.	51μΩ•in

Cold-Worked Properties

Cold Reduction (%)	Tensile (ksi)	0.2% Yield (ksi)	Elong. (%)
10	129	90	40
20	145	125	30
30	168	155	15
40	194	180	10
50	210	195	7

Alloy C-276 cannot be hardened by heat treatment but can be hardened by cold working using various means. The increase in tensile and yield properties is dependent on the percentage of cold reduction induced on the material.

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Aqueous Corrosion Data

Media	Common Name	Temp. °F (°C)	Corrosion Rate (mpy)
80% $C_2H_4O_2$	Acetic Acid	Boiling	0.15
10% NH_3Br	Ammonium Bromide	176 (80)	Nil
10% NH_3Br	Ammonium Bromide	Boiling	Nil
10% $FeCl_3$	Ferric Chloride	Boiling	2
88% CH_2O_2	Formic Acid	Boiling	1
0.2% HCl	Hydrochloric Acid	Boiling	0.60
1% HCl	Hydrochloric Acid	Boiling	13.3
2% HCl	Hydrochloric Acid	Boiling	43
5% HCl	Hydrochloric Acid	140 (60)	10
20% HCl	Hydrochloric Acid	212 (100)	154
3% HF	Hydrofluoric Acid	176 (80)	53
10% HF	Hydrofluoric Acid	75 (24)	2
10% HF	Hydrofluoric Acid	176 (80)	28
Concentrated HF	Hydrofluoric Acid	75 (24)	24
Concentrated HF	Hydrofluoric Acid	176 (80)	80
10% HBr	Hydrogen Bromide	176 (80)	<1
10% HBr	Hydrogen Bromide	Boiling	<1
10% HNO_3	Nitric Acid	Boiling	15
65% HNO_3	Nitric Acid	Boiling	888
20% H_3PO_4	Phosphoric Acid	Boiling	<1
60% H_3PO_4	Phosphoric Acid	Boiling	1
85% H_3PO_4	Phosphoric Acid	212 (100)	5
85% H_3PO_4	Phosphoric Acid	Boiling	121
50% NaOH	Sodium Hydroxide	Boiling	1
10% H_2SO_4	Sulfuric Acid	Boiling	2
20% H_2SO_4	Sulfuric Acid	176 (80)	3
40% H_2SO_4	Sulfuric Acid	176 (80)	5
80% H_2SO_4	Sulfuric Acid	176 (80)	4

Coefficient of Thermal Expansion

Temperature (°F)	Coefficient (µin./in.°F)
75 to 200	6.2
75 to 400	6.7
75 to 600	7.1
75 to 800	7.3
75 to 1000	7.4

Thermal Conductivity

Temperature (°F)	Conductivity (Btu•in/ft²•h•°F)
200	77
400	90
600	104
800	117
1000	132

Applicable Specifications*

Form	ASTM	ASME	VdTÜV
Bar	B574, B564[1]	SB574, SB564[1]	400
Plate & Sheet	B575	SB575	400
Welded Pipe	B619	SB619	-
Welded Tube	B626	SB626	-
Seamless Pipe & Tube	B622	SB622	-

[1] On diameters above 3.5", B564/SB564 is dual certified.
** EN10204-3.1 applies to all product forms.*

Please contact Corrosion Materials for a complete list of items available from our extensive inventory, as well as our value-added processing services.

We supply a complete range of items in many alloys, including C-276, 22, B-2, B-3®, 200/201, 400, 405, K-500, 625, 600, 800H/HT®, 20, F255, 6B, Titanium Gr. 2 and Titanium Gr. 5.

Our machine shop, welding shop and processing departments are equipped with state-of-the-art manufacturing equipment allowing Corrosion Materials the ability to provide the service you desire along with the economic and technical advantages you need and deserve.

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