CORROSION MATERIALS

"Your Corrosion Alloy Specialist"

"ISO 9001-2008 Certified
ISO Registered Since 1993"

Alloy 405

UNS N04405

Alloy 405(R04405) is a nickel copper alloy and is an enhanced machining version of Alloy 400. A controlled amount of sulfur is added to improve machinability. Corrosion resistance characteristics and physical properties are similar to those of Alloy 400, but mechanical property ranges slightly different. Alloy 405 can also be slightly magnetic at room temperature like Alloy 400. Typical applications include mainly automatic screw machine products.

Machining

Alloy 405 was specifically designed to have good machinability and is recommended for use with automatic screw machines. The Ni-Cu sulfides resulting from the sulfur in its composition act as chip breakers. These inclusions cause the surface finish to be not as smooth as Alloy 400.

Resistance to Corrosion

Alloy 405 exhibits the same corrosion resistance as Alloy 400. These alloys are resistant to corrosion in many reducing media. Like Alloy 400, it is one of the few alloys that can be used in contact with fluorine, hydrofluoric acid, hydrogen fluoride or their derivatives. Exceptional resistance has been proven in hydrofluoric acid in all concentrations up to the boiling point. Alloy 405 is also resistant to many forms of sulfuric and hydrochloric acids under reducing conditions. Behavior in seawater is also excellent.

Limiting Chemical Composition

Ni[1].....63.0 Min.	Si.....0.50 Max.
Fe.....2.50 Max.	Cu.....28.0-34.0
C.....0.3 Max.	S.....0.025-0.060 Max.
Mn.....2.0 Max.	

[1] Includes Co

Physical Properties

Density@ 68°F	0.319 lb/in.^{3}
Elastic Modulus	26.0 ksi
Coefficient of Thermal Expansion	2370°F to 2460°F
Specific Heat @ 68°F	0.009 Btu/lb/°F
Curie Temperature	70-120°F 21-49°C
Poisson's Ratio	0.32
Thermal Conductivity @ 70°F	12.6 Btu/ft - h -°F
Electrical Resistivity @ 70°F	510 nΩ•m
Melting Range	2370 °F -2460 °F

Impact Strength

Condition	Impact Strength[1] ft - lb	
	IZOD	Charpy
Hot Rolled	96	187
Cold Drawn	99	140
Annealed	120+	196

[1] Test results are at room temperature

Thermal Expansion

Temperature, °F	Mean Linear Expansion in/in/°F x 10^{-6}
200	7.6
400	8.4
600	8.7
800	9.0
1000	9.2
1200	9.4
1400	9.7
1600	9.9
1700	10.0
1800	10.1
2000	10.4

Typical Mechanical Properties of Round Bar

Condition	Tensile (ksi)	0.2% Yield (ksi)	Elongation (%)	Hardness (HRB) Brinell(3000kg)	Rockwell
Annealed	70 - 85	25 - 40	35 - 50	110 -140	60 to 76 HRB
Annealed	75 - 90	35 - 60	30 - 45	130 -170	72 - 86 HRB
Cold-Drawn	85 -115	50 -105	15 - 35	160 - 245	85 HRB - 23HRC

1. The ranges shown are composites for various product sizes and therefore are not suitable for specification purposes. Hardness values are suitable for specification purposes provided tensile properties are not also specified.

Aqueous Corrosion Data

Media	Common Name	Temp. °F (°C)	Corrosion Rate (mpy)
C_3CO_2H - All Concentrations	Acetic Acid	70 (21)	<4
4% NaOH	Caustic	68 (20)	0.16
23% NaOH	Caustic	220 (104)	0.2
50% NaOH	Caustic	Boiling	<1
75% NaOH	Caustic	275 (135)	1.7
40% CH_2O_2	Formic Acid	Boiling	2.7
0.5% HCl - No Aeration	Hydrochloric Acid	Boiling	29
1% HCl - No Aeration	Hydrochloric Acid	Boiling	42
5% HCl - No Aeration	Hydrochloric Acid	Boiling	44
Up to 10% HCl	Hydrochloric Acid	86 (30)	<10
12% HF	Hydrofluoric Acid	182 (83)	22
25% HF - Saturated w/Air	Hydrofluoric Acid	86 (30)	37
25% HF - Purged w/Nitrogen	Hydrofluoric Acid	86 (30)	0.2
50% HF - Saturated w/Air	Hydrofluoric Acid	176 (80)	39
50% HF - Purged w/Nitrogen	Hydrofluoric Acid	176 (80)	0.5
Anhydrous HF	Hydrofluoric Acid	80 (27)	3.2
Anhydrous HF	Hydrofluoric Acid	200 (88)	4.7
HF	Hydrogen Flouride Gas	1112 (600)	13
H_3PO_4 - All Concentrations	Phosphoric Acid	176 (80)	<10
KOH	Potash Liquor	235 (113)	0.6
5% H_2SO_4	Sulfuric Acid	214 (101)	3.4
19% H_2SO_4	Sulfuric Acid	219 (104)	7.5
50% H_2SO_4	Sulfuric Acid	253 (123)	650
96% H_2SO_4	Sulfuric Acid	560 (293)	3300

Applicable Specifications

Alloy 400 - Form	ASTM	ASME	British Standard	Federal Specification	European Standard	Other
Bar	B164, B564[1]	SB164, SB564[1]	BS3076-NA13	QQN281D[2]	EN 10204-3.1.B	AMS 4674F

[1] Dual certified on diameters including and above 3 1/2 " in diameter
[2] Class B, Form 1, Amendment II.

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, 200/201, Alloy 22 and 600. Bar products are also available in Alloy 20, K500, 800H/HT®, and Alloy 6B, as well as various Ti grades.

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