

**INCOLOY® alloy 020 (UNS N08020) has excellent corrosion resistance in chemical environments containing sulfuric acid, and useful resistance to environments containing chlorides, nitric acid, and phosphoric acid.** Other uses include the production of gasoline, solvents, explosives, inorganic and organic chemicals, pharmaceuticals, and food and synthetic materials. INCOLOY alloy 020 is readily fabricated to produce mixing tanks, heat exchangers, process piping, pickling equipment, pumps, valves, fasteners and fittings. Applications for alloy 020 requiring resistance to aqueous corrosion are essentially the same as those for INCOLOY alloy 825.

**Table 1 - Limiting Chemical Composition, %**

Nickel .....	32.0-38.0
Chromium.....	19.0-21.0
Copper .....	3.0-4.0
Molybdenum .....	2.0-3.0
Iron .....	Balance*
Carbon.....	0.07 max.
Niobium + Tantalum .....	8 x C -1.0
Manganese .....	2.0 max.
Phosphorus .....	0.045 max.
Sulfur .....	0.035 max.
Silicon .....	1.0 max.

\*Reference to the 'balance' of a composition does not guarantee this is exclusively of the element mentioned but that it predominates and others are present only in minimal quantities.

Publication Number SMC-018  
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## Physical and Mechanical Properties

**Table 2 - Physical Properties**

Density, lb/in <sup>3</sup> .....	0.292
g/cm <sup>3</sup> .....	8.08
Shear Modulus, 10 <sup>3</sup> ksi .....	11
GPa .....	76
Young's Modulus, 10 <sup>3</sup> ksi .....	28
GPa .....	193
Specific Heat, Btu/lb•°F .....	0.12
J/kg•°C .....	500
Electrical Resistivity, ohm•circ mil/ft .....	651
μΩ•m .....	1.08
Thermal Conductivity, Btu•in/ft <sup>2</sup> •h•°F .....	85
W/m•°C .....	12.3
Coefficient of Expansion, 77-212°F, 10 <sup>-6</sup> in/in•°F .....	8.2
25-100°C, μm/m•°C .....	14.7

**Table 3 - Typical Room Temperature Mechanical Properties**

Tensile Strength, ksi .....	90
MPa .....	620
Yield Strength (0.2% Offset), ksi .....	45
MPa .....	300
Elongation, % .....	40



# INCOLOY® alloy 020

**Table 4 - Room Temperature Tensile Test Results of Cold Worked INCOLOY alloy 020**

Cold Reduction (%)	Yield Strength (0.2% Offset)		Tensile Strength		Elongation (%)	Hardness (Rockwell)
	ksi	MPa	ksi	MPa		
0*	44.4	306	95.8	661	38	B83
20	111.0	765	119.8	826	13	C23
30	124.3	857	131.5	907	8	C28
40	127.5	879	135.0	931	7	C27
50	139.5	962	147.5	1017	4	C30
60	139.9	965	149.3	1029	5	C31

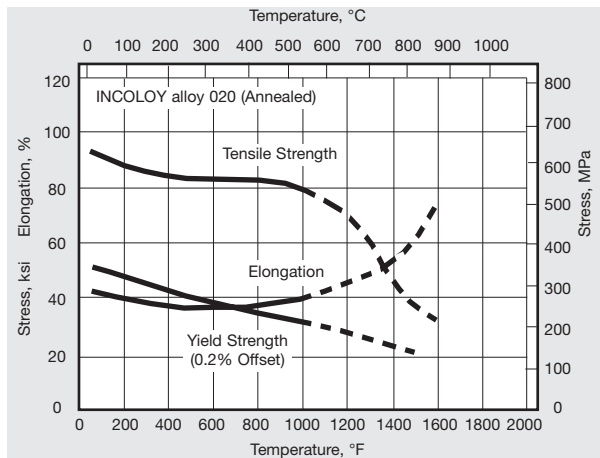
\*Stabilize anneal.

## Corrosion Resistance

**Table 5 - Sulfuric Acid Corrosion Data for Strip\***

Temperature		H <sub>2</sub> SO <sub>4</sub> (%)	Corrosion Rate	
°C	°F		mpy	mm/a
50	122	70	2	0.051
60	140	20	0	0
60	140	70	3	0.076
60	140	90	4	0.102
75	167	70	5	0.127
85	185	20	18	0.457
85	185	70	7	0.178
85	185	90	15	0.381
95	203	90	27	0.686
Boiling		20	17	0.432

\*Test duration - 168 hours.



**Figure 1.** High temperature mechanical properties.

— Typical usage range.

## Fabricating

Information on fabricating is available in the Special Metals publication “Fabricating” or on our website, [www.specialmetals.com](http://www.specialmetals.com).

## Joining

**Table 6-** Recommended Welding Products

Shielded Metal Arc Welding	Gas Tungsten Arc Welding, Gas Metal Arc Welding
INCONEL welding electrode 112	INCONEL filler metal 625
INCONEL welding electrode 122	INCONEL filler metal 622
INCO-WELD welding electrode 686CPT®	INCO-WELD filler metal 686CPT®

Information on joining is available in the Special Metals publication “Joining” on the website, [www.specialmetals.com](http://www.specialmetals.com).

## Heat Treatments

Hot forming should be in the range 1400-2150°F (760-1175°C). INCOLOY alloy 020 is normally used in the annealed condition. Annealing: 1800-1850°F (982-1010°C)/ for a time commensurate with section size/AC.

## Machining

Information on machining is available in the Special Metals publication “Machining” on the website, [www.specialmetals.com](http://www.specialmetals.com).

## Available Products and Specifications

INCOLOY alloy 020 is designated as UNS N08020. Standard product forms include pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

**Rod, Bar, Wire and Forging Stock** - ASTM B 462, ASTM B 472, ASTM B 473, ASME SB 472, ASME SB 473, ISO 9723, ISO 9724, ISO 9725, DIN 17752-17754

**Plate, Sheet and Strip** - ASTM A 240, ASTM A 480, ASTM B 463, ASTM B 906, ASME SA 240, ASME SA 480, ASME SB 463, ASME SB 906, ISO 6208, DIN 17750

**Pipe and Tube** - ASTM B 729, ASTM B 829, ASTM B 468, ASTM B 751, ASTM B 464, ASTM B 775, ASTM B 474, ASME SB 729, ASME SB 829, ASME SB 468, ASME SB 751, ASME SB 464, ASME SB 775, ASME SB 474, ISO 6207, DIN 77751

**Other** - DIN 17744, ASTM B 366, ASTM B 462, ASTM B 471, ASTM B 475, ASME SB 366, ASME SB-462, ASME SB 471, ASME SB 475



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