MATERIAL CHARACTERISTICS - METAL

Aluminum

2024

·Non-magnetic
·Aircraft Grade
·1/3 the weight of steel
·Heat treat to increase hardness
·Good electrical conductivity (30% of copper)
·Good heat conductivity (70 btu/hr/ft²/°F/ft)
·Anodizing increases corrosion resistance & is available in many colors

6061 & 7075

·Aircraft grade
·Heat treat to increase hardness

1100, 3003, 5052

·Commercial (common) alloys
·Not heat treatable
·Gasket material - softer alloys

Beryllium Copper

Alloy 25

·Electrical Alloy
·Good electrical conductivity (17-22% of copper)
·Good heat conductivity (68 btu/hr/ft²/°F/ft)
·Age hardenable (easy to form in annealed state but can be hardened afterward thru heat treating)
·Non-magnetic & corrosion resistant
·Extensively used for springs, sring washers, & clips
·Good plating base

Brass

Alloy 230, 84/16, Copper/Zinc

·Non-Magnetic
·Good electrical conductivity (37% of copper)
·Good heat conductivity (92 btu/hr/ft²/°F/ft)
·Spring temper provides a flatter part and a cleaner cut than half hard or softer temper
·Corrosion resistant
·Excellent plating base

Alloy 260 or 360, 70/30, Copper/Zinc

·Non-Magnetic
·Good electrical conductivity (26% of copper)
·Good heat conductivity (70 btu/hr/ft²/°F/ft)
·Spring temper provides a flatter part and a cleaner cut than half hard or softer temper
·Corrosion resistant
·Excellent plating base

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Copper	**Alloy 110, Electrolytic tough pitch, 99.9% Copper** ·Non-magnetic ·Corrosion resistant ·Best electrical grade copper ·Best electrical (100% of copper) & thermal (225 btu/hr/ft²/°F/ft) conductivity ·Good plating base ·Excellent sealing capability
Cobalt Alloys	**Alloy 188** ·Strength and oxidation resistant to 2000°F ·Good post-aging ductility ·Resistant to sulfate deposit hot corrosion **Waspaloy** ·High strength ·Oxidation resistant to 1750°F turbines and aircraft jet engines.
Phos. Bronze	**Grade A, Spring Temper** ·Non-magnetic ·Fair corrosion resistant ·Fair for electrical applications (15% of copper) ·High strength ·High temperature resistance ·Good bearing surface ·Good spring material
Titanium	**Titanium Coil - AMS4900** ·Commercial pure ·Extreme high temperature applications ·High stength to weight ratio ·Mainly used in aircraft ·Quite expensive ·Corrosion resistant **Titanium Rod - 6AL-4V** ·Extreme high temperature applications ·High strength to weight ratio ·Mainly used in aircraft ·Less expensive than commercial pure ·Corrosion resistant

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Nickel Alloys

Inconel® 600

·Virtually immune to chloride ion stress corrosion cracking
·Good caustic corrosion resistance
·Resistant to dry Cl2 to about 1000°F
·Oxidation resistance to 2000°F
·Carburization resistance

Inconel® 601

·Outstanding oxidation resistance to 2200°F
·Highly resistant to carburization
·Good creep and rupture strength
·Metallurgical stability

Inconel® 625

·High creep-rupture strength
·Oxidation resistant to 1800°F
·Good fatigue resistance
·Excellent weldability
·Outstanding resistance to chloride pitting and crevice corrosion
·Immune to chloride ion stress corrosion cracking
·Resistant to seawater under both flowing and stagnant conditions and under fouling

Inconel® 718

·Good mechanical properties: tensile, fatigue and creep-rupture
·Excellent welding characteristics, resistant to postweld age cracking
·Oxidation resistant throughout its useful temperature range

Monel® 400

·Resistant to seawater and steam at high temperatures
·Excellent resistance to rapidly flowing brackish water or seawater
·Excellent resistance to stress corrosion cracking in most freshwaters
·Particularly resistant to hydrochloric and hydrofluoric acids when they are de-aerated

·Offers some resistance to hydrochloric and sulfuric acids at modest temperatures and concentrations, but is seldom the material of choice for these acids

·Excellent resistance to neutral and alkaline salt
·Resistance to chloride induced stress corrosion cracking
·Good mechanical properties from sub-zero temperatures up to 1020° F
·High resistance to alkalis

Monel® R-405

·Good machinability and is recommended for use with automatic screw machines
·Resistant to seawater and steam at high temperatures
·Excellent resistance to rapidly flowing brackish water or seawater
·Excellent resistance to stress corrosion cracking in most freshwaters
·Particularly resistant to hydrochloric and hydrofluoric acids when they are de-aerated

·Offers some resistance to hydrochloric and sulfuric acids a modest temperatures and concentrations, but is seldom the material of choice for these acids
·Excellent resistance to neutral and alkaline salt
·Resistance to chloride induced stress corrosion cracking
·High resistance to alkalis

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Nickel Alloys (cont)

Monel® K-500

·Corrosion resistance in an extensive range of marine and chemical environments. From pure water to non-oxidizing mineral acids, salts and alkalis.

·Excellent resistance to high velocity sea water

·Resistant to a sour-gas environment

·Excellent mechanical properties from sub-zero temperatures up to about 480C

·Non-magnetic alloy

AL-6XN®

·Over 25 years of proven seawater service

·50% stronger than stainless

·ASME coverage up to 800°F

·Easily welded

·Excellent resistance to pitting and crevice corrosion in chloride solutions

·Practical immunity to stress corrosion cracking in NaCl environments

·High strength and toughness

Alloy 20

·Excellent resistance to hot sulfuric acid

·Resistant to intergranular corrosion in the as-welded condition

·Chloride stress corrosion cracking resistance

Hastelloy® C276

·Most universally corrosion resistant material available today.

·Excellent resistance to pitting, stress-corrosion cracking and to oxidizing atmospheres.

·Excellent resistance to corrosion by seawater especially under crevice conditions, which induce attack in other commonly used materials.

Steel

CRS, Commercial Quality

·.010or above #4 temp (1/4 H)

·Below .010 #1 temp (FH)

·Inexpensive

·General applications

·Good plating base material (magnetic & it will corrode)

·Fair electrical conductor (12% of copper)

·Highest strength for cost

Spring Steel High Carbon

1050/1074/1075/1095 - .005 and above

·May be heat treated to increase hardness

·Can be formed easily in annealed state then hardened thru heat treating

·Used for springs, spring washers, & clips

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Stainless Steel

300 Series

·.010 or above (Annealed)

·.005-.009 (HH)

·.001-.004 (FH)

·Slightly magnetic. Least magnetic in annealed condition

·General applications

·Greater strength than steel

·Excellent corrosion resistance

400 Series

·Steel & Plate vs. Stainless - in many instances a steel part with the additional plating process changes are the same

Nitronic 50

·High strength austenitic alloy

·Good corrosion resistance

·Maintains strength at high temperatures as well as sub-zero temperatures.

Nitronic 60

·Excellent galling resistance, even at elevated temperatures.

·Maintains decent strength up to temperatures of 1800°F and has oxidation resistance similar to that of 309 stainless steel.

·General corrosion resistance is between that of 304 and 316 stainless steel.

Duplex Stainless Steel

2205

·High resistance to chloride stress corrosion cracking

·Chloride pitting and crevice corrosion resistance superior to 317L stainless

·Good general corrosion resistance

·High strength

·Good sulfide stress corrosion resistance

·Useful up to 600°F

2507

·High resistance to chloride stress corrosion cracking

·High strength

·Superior resistance to chloride pitting and crevice corrosion

·Good general corrosion resistance

·Suggested for applications up to 600° F

·Low rate of thermal expansion

·Combination of properties given by austenitic and ferritic structure

·Good weldability and workability

Zeron® 100

·Resistant to pitting and crevice corrosion in warm seawater with a guaranteed corrosion performance (PREN > 40)

·Excellent resistance to stress corrosion cracking in both chloride and sour environments

·Superior resistance to sulfuric acid at most concentrations

·Improved resistance over austenitic stainless to erosion corrosion and corrosion fatigue

·High Strength (80,000 psi minimum Yield Strength) permitting designs to reduce weight versus other corrosion resistant alloys

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