Technical Data Sheet

ATI 188™ Alloy

High Temperature, Cobalt-Based Alloy

(UNS R30188)

GENERAL INFORMATION

The ATI 188™ alloy is a cobalt-based, solid-solution strengthened alloy that has excellent high temperature strength, excellent oxidation resistance up to 2000°F (1093°C), and good sulfidation resistance. This alloy also has good forming and welding characteristics, which make it useful in fabricating gas turbine components such as combustion cans and transition ducts.

The alloy has a face-centered cubic structure. High tungsten content provides solid solution strengthening, while the precipitation of M_6C and $M_{23}C_6$ carbides further increases the strength. High chromium content and the addition of lanthanum promote oxidation resistance through formation of a tenacious oxide.

FORMS AND CONDITIONS AVAILABLE

The ATI 188™ alloy is available in sheet and strip product forms. The alloy is generally supplied in the solution annealed condition.

The ATI 188™ alloy (UNS R30188) is covered by the AMS 5608 specification.

Limiting Chemical Composition of ATI 188™ Alloy (AMS 5608 Specification Limits for UNS R30188)	
Element	**Weight Percent**
Carbon	0.05 – 0.15
Manganese	1.25 max
Silicon	0.20 – 0.50
Phosphorus	0.020 max
Sulfur	0.015 max
Chromium	20.00 - 24.00
Nickel	20.00 - 24.00
Tungsten	13.00 – 16.00
Lanthanum	0.02 – 0.12
Boron	0.015 max
Iron	3.00 max
Cobalt	Remainder

PHYSICAL PROPERTIES

Density	0.330 lb/in^3 (9.13 g/cm^3)
Melting Range	2375 – 2475 °F (1300 – 1355 °C)
Electrical Resistivity	36.3 μΩ·in (92.2 μΩ·cm)
Magnetic Permeability at 200 oersteds	1.01
Thermal Conductivity	72 Btu·in/ft^2·h·°F (10.4 W/m·K)

Specific Heat	0.096 Btu/lb·°F (402 J/kg·°C)
Coefficient of Thermal Expansion, RT – 200°F	6.7 × 10^{-6} in/in·°F (12.1 μm/m·°C)

MECHANICAL PROPERTIES

Typical room temperature mechanical properties of annealed ATI 188™ alloy are listed in the table below.

Tensile Strength		0.2% Yield Strength		Elongation in 2 in. or 50 mm
ksi	MPa	ksi	MPa	%
139	955	64	442	54

The ATI 188™ alloy retains excellent strength and ductility at elevated temperatures. The following figure shows the short-term elevated temperature tensile properties of ATI 188™ alloy cold-rolled and solution annealed sheet up to 2000°F.

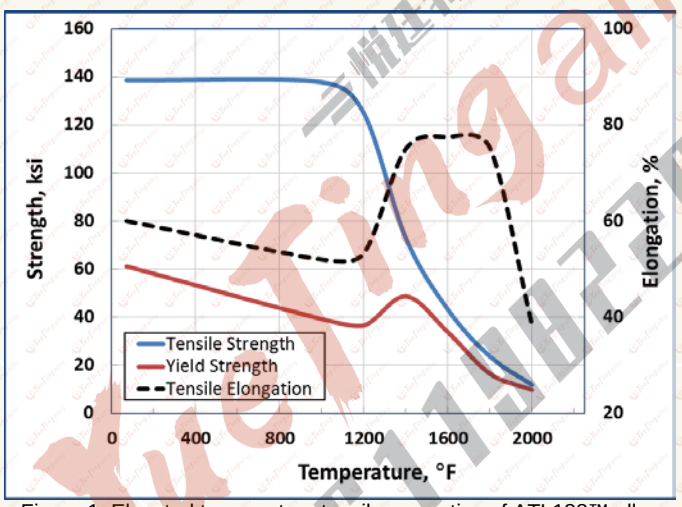

Figure 1. Elevated temperature tensile properties of ATI 188™ alloy

Stress-rupture data for ATI 188™ alloy sheet is presented as a function of the Larson Miller Parameter. The LMP = T [log t_r + C], where T is the temperature in Kelvin, t_r is the stress-rupture time in hours, and the constant C=20.

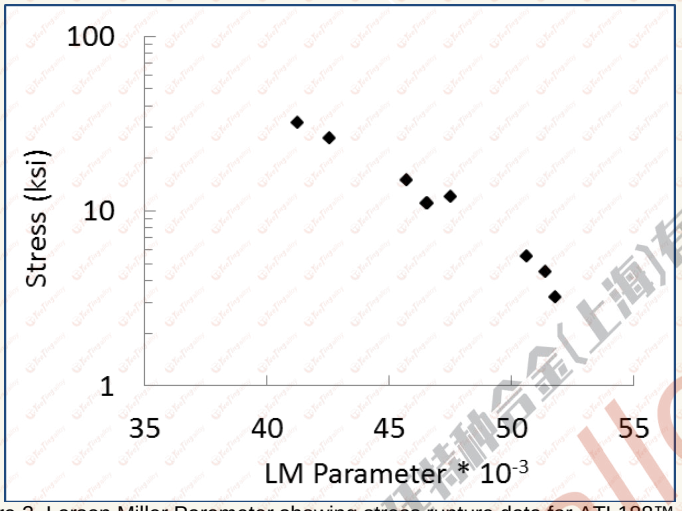

Figure 2. Larson Miller Parameter showing stress rupture data for ATI 188™ alloy

The ATI 188™ alloy work hardens rapidly during cold working due to the carbides in the microstructure. The following figure shows the change in mechanical properties as mill annealed 0.032" thick sheet is cold worked through 40%.

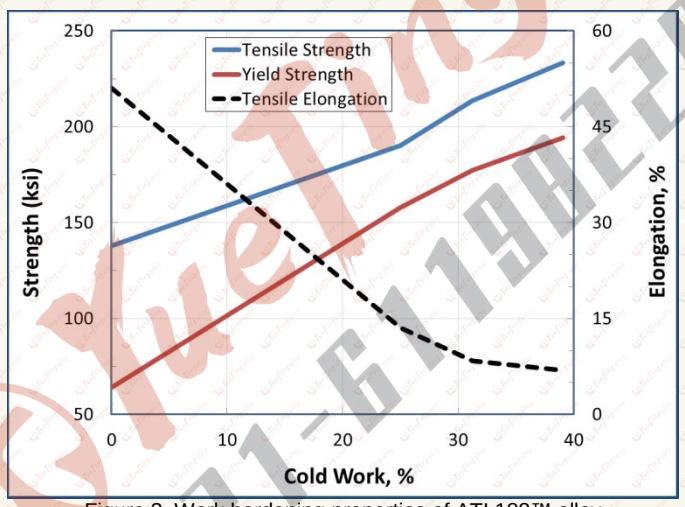

Figure 3. Work hardening properties of ATI 188™ alloy

FABRICATION

Forming / Welding / Joining

The ATI 188™ alloy has good forming and welding characteristics, but work-hardens rapidly. Forming, machining, and welding can all be accomplished by standard methods.

Heat Treatment

The ATI 188™ alloy is solution annealed at a temperature between 2125-2250°F (1163-1232°C), and then rapid air-cooled or water-quenched.