INCOLOY® alloy A-286 (UNS S66286/W. Nr. 1.4980) is an iron-nickel-chromium alloy with additions of molybdenum and titanium. It is age-hardenable for high mechanical properties. The alloy maintains good strength and oxidation resistance at temperatures up to about 1300°F (700°C). The limiting chemical composition is given in Table 1. The alloy is austenitic in all metallurgical conditions.

The high strength and excellent fabrication characteristics of INCOLOY alloy A-286 make the alloy useful for various components of aircraft and industrial gas turbines. It is also used for fastener applications in automotive engine and manifold components subject to high levels of heat and stress and in the offshore oil and gas industry.

Table 1 - Limiting Chemical Composition, %

Nickel	24.0-27.0
Iron	Balance*
Chromium	13.5-16.0
Titanium	1.90-2.35
Molybdenum	1.0-1.5
Vanadium	0.10-0.50
Carbon	0.08 max.
Manganese	2.0 max.
Silicon	1.0 max.
Aluminum	0.35 max.
Sulfur	0.030 max.
Boron	0.001-0.01

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

Table 2 - Physical Properties

Density, lb/in^3	0.287
g/cm^3	7.94
Melting Range, °F	2500-2600
°C	1370-1430
Specific Heat, Btu/lb•°F	0.100
J/kg•°C	419
Young's Modulus, 10^3 ksi	29.1
GPa	201
Permeability at 200 oersted (15.9 kA/m)	1.007

Physical Properties

Some physical properties at room temperature are shown along with melting range in Table 2. Values for thermal and electrical properties at high temperatures are listed in Table 2. Physical properties were determined on specimens in the age-hardened condition.

Table 3 - Thermal and Electrical Properties

Temperature	Coefficient of Expansion[a]	Thermal Conductivity	Electrical Resistivity
°F	10^{-6} in/in•°F	Btu•in/ft^2•h•°F	ohm•circ mil/ft
70	-	88	547
200	9.09	97	-
400	9.16	112	-
600	9.42	126	-
800	9.61	140	-
1000	9.74	155	695
1200	9.91	172	715
1350	-	-	722
1400	9.67	-	-
1500	-	-	736
°C	µm/m•°C	W/m•°C	µΩ•m
20	-	12.7	0.910
100	16.4	14.1	-
200	16.5	16.0	-
300	16.9	17.9	-
400	17.2	19.8	-
500	17.5	21.8	-
600	17.7	23.8	1.175
700	17.7	-	1.196
800	-	-	1.217

[a]Mean coefficient of linear expansion between 80°F (27°C) and temperature shown.

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Mechanical Properties

In the age-hardened condition, INCOLOY alloy A-286 has high strength at room temperature and retains high levels of strength at temperatures to about 1300°F (700°C). Figure 1 shows the effect of temperature on tensile properties.

INCOLOY alloy A-286 has good creep-rupture strength during extended high-temperature exposure. Figure 2 shows stresses for 100 and 1000 hour rupture lives at various temperatures. Stress levels to produce creep rates of 1%/100 h and 1%/1000 h are shown in Figure 3.

Mechanical properties reported here are for material given the following heat treatment: solution treatment at 1800°F (980°C) plus age hardening at 1325°F (720°C)/16 h and air cooling.

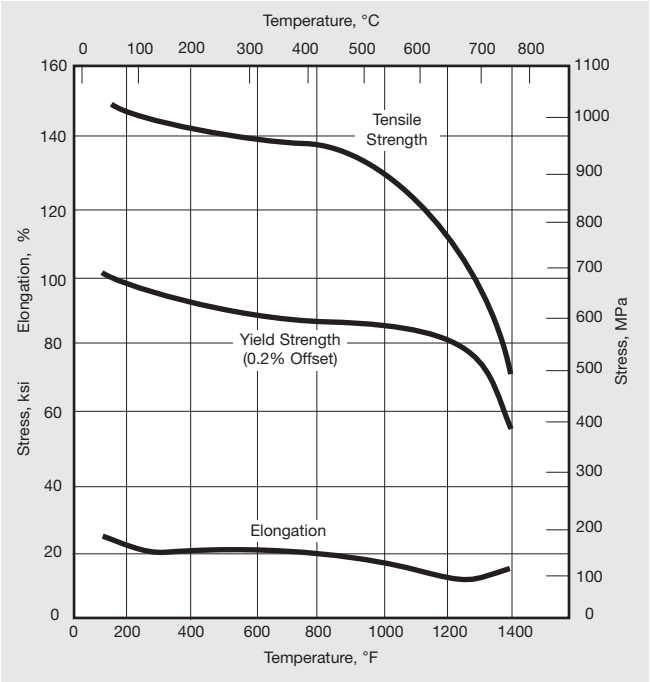

Figure 1. Tensile properties of age-hardened INCOLOY alloy A-286.

Corrosion Resistance

The nickel and chromium contents of INCOLOY alloy A-286 provide resistance to corrosion and oxidation. The alloy has excellent resistance to oxidation at service temperatures up to about 1300°F (700°C).

Fabrication

INCOLOY alloy A-286 is readily fabricated by standard procedures for stainless steels and nickel alloys.

Cold forming should be done on material in the solution-treated condition. Procedures, forces, and work-hardening rates are similar to those for INCONEL alloy 600 and INCOLOY alloy 800.

For hot forming, the metal should be heated to 2100°F (1150°C). Any final reductions at under 1800°F (980°C) should be greater than 10% to avoid formation of large grains during later solution treatment. No forming should be done below 1700°F (930°C).

Heat treatment of INCOLOY alloy A-286 consists of solution treatment at either 1800°F (980°C) or 1650°F (900°C) and rapid cooling followed by age hardening at 1325°F (720°C) for 16 hours and air cooling. The 1800°F (980°C) solution treatment produces the highest creep-rupture strength in age-hardened material whereas the 1650°F (900°C) treatment results in improved ductility and room-temperature tensile strength.

Information on fabricating is available in the Special Metals publication “Fabricating” on the website, www.specialmetals.com.

Machining

Information on machining is available in the Special Metals publication “Machining” on the company website, www.specialmetals.com.

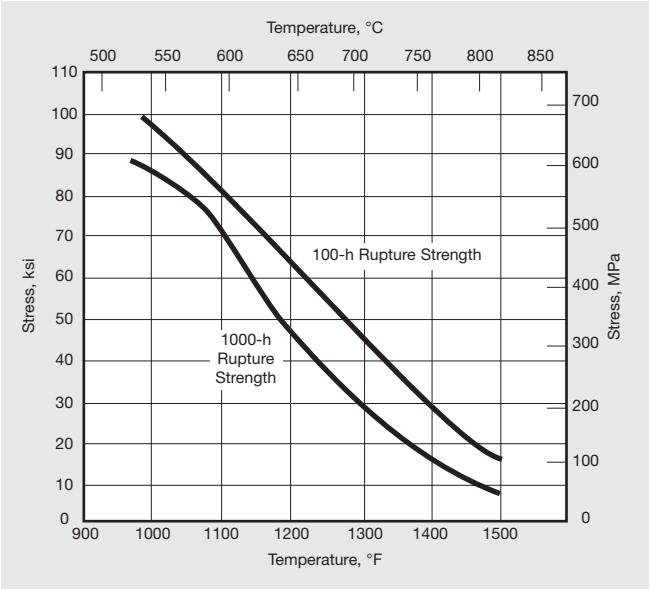

Figure 2. Rupture strength of age-hardened INCOLOY alloy A-286

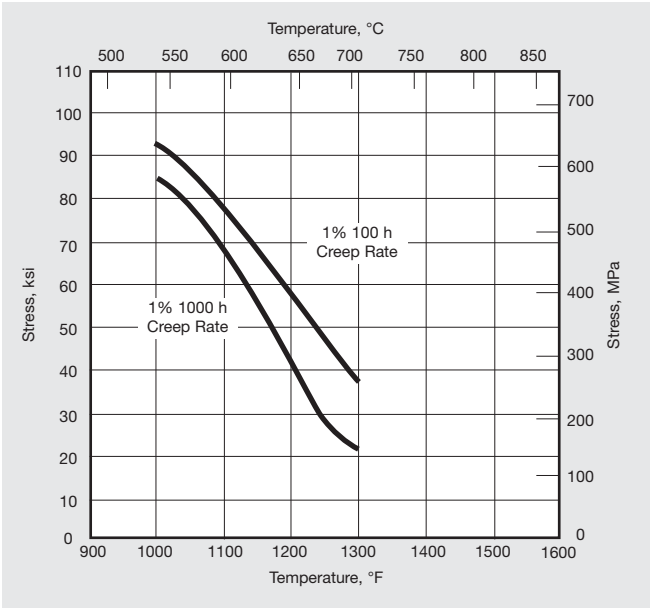

Figure 3. Creep strength of age-hardened INCOLOY alloy A-286

Available Products and Specifications

INCOLOY alloy A-286 is designated as UNS S66286 and W. Nr. 1.4980. Standard product forms are sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

Rod, Bar, Wire and Forging Stock - ASTM A 638, ASME SA 638, SAE AMS 5726, SAE AMS 5731, SAE AMS 5732, SAE AMS 5734, SAE AMS 5737, SAE AMS 5895, BS HR 51, BS HR 52, AECMA PrEn2171, AECMA PrEN2119, AECMA PrEN2172, AECMA PrEN2173, AECMA PrEN2174, AECMA PrEN2303, AECMA PrEN2304, AECMA PrEN2398, AECMA PrEN2399, AECMA PrEN3510

Plate, Sheet and Strip - SAE AMS 5525, SAE AMS 5858, AECMA PrEN2175, AECMA PrEN2417

Pipe and Tube - SAE AMS 5731, SAE AMS 5732, SAE AMS 5734, SAE AMS 5737, SAE AMS 5895

Others - ASTM A 453, SAE AMS 7235, BS HR 650, ASME SA 453

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