Alloy 80A/N07080/W. Nr. 2.4952 & 2.463

NIMONIC® Alloy 80A (UNS N07080) is an age-hardenable, nickel-chromium alloy with additions of titanium and aluminum. It is designed for high-temperature applications where superior creep, fatigue, and oxidation resistance are required. This material is primarily used in gas turbine blades, exhaust valves, aerospace applications, and other high-temperature environments.

CHEMICAL COMPOSITION:

Alloy 80A's composition has been carefully defined to ensure its optimal performance in high-temperature environments.

Element	Min (%)	Max (%)
Nickel (Ni)	65.0	70.0
Chromium (Cr)	18.0	21.0
Titanium (Ti)	1.8	2.7
Aluminum (Al)	1.0	1.8
Cobalt (Co)	-	2.0
Iron (Fe)	-	3.0
Manganese (Mn)	-	1.0
Copper (Cu)	-	0.2
Boron (B)	-	0.008
Zirconium (Zr)	–	0.15
Lead (Pb)	–	0.0025
Sulfur (S)	–	0.015

PHYSICAL PROPERTIES:

The physical properties of Alloy 80A at room temperature and elevated temperatures are critical for its applications. The alloy exhibits excellent thermal and electrical properties.

Property	Value
Density	8.19 g/cm³
Melting Range	1320–1365°C
Magnetic Permeability	1.0006 at 20°C
Thermal Conductivity at 20°C	11.2 W/m·K
Specific Heat at 20°C	0.107 kJ/kg·°C

Thermal Properties at Various Temperatures:

Temperature (°C)	Specific Heat (kJ/kg·°C)	Thermal Conductivity (W/m·K)	Electrical Resistivity (μΩ·cm)	Linear Thermal Expansion (10^{-6}/K)
20°C	0.107	11.2	124	12.7
100°C	0.112	12.6	212	13.3
200°C	0.118	14.4	208	13.7
300°C	0.124	16.1	202	14.1
400°C	0.131	17.8	196	14.4
500°C	0.137	19.4	189	14.7
600°C	0.143	20.8	179	15.0
700°C	0.150	22.3	161	15.5
800°C	0.156	24.5	130	16.2
900°C	0.162	26.5	–	17.1
1000°C	0.168	28.4	–	18.1

MECHANICAL PROPERTIES:

Alloy 80A is known for its high tensile strength, exceptional creep resistance, and good fatigue performance at elevated temperatures.

Temperature (°C)	Yield Strength (Rp 0.2) (MPa)	Tensile Strength (Rm) (MPa)	Elongation (A) (%)
20°C	600	930	20
100°C	586	930	–
200°C	568	930	–
300°C	560	920	–
400°C	540	910	–
500°C	520	900	–
600°C	500	890	–

CREEP RESISTANCE:

Temperature (°C)	Time (hours)	Yield Strength (Rp 1.0 MPa)	Tensile Strength (Rm) MPa
500°C	10,000	624	745
550°C	10,000	523	582
600°C	10,000	398	433
650°C	10,000	275	300
700°C	10,000	183	186
750°C	10,000	106	114
800°C	10,000	58	70

Corrosion Resistance:

NIMONIC® Alloy 80A shows excellent oxidation resistance, especially at high temperatures, where it forms a stable oxide layer to protect the alloy from further degradation.

Temperature (°C)	Oxidation Weight Loss (mg/cm²)
750°C	1.8
900°C	3.9
1000°C	7.1
1100°C	8.0
1200°C	9.1

APPLICATIONS:

> **Gas Turbine Components:**

Turbine blades, rings, discs, and other components exposed to high temperatures.

> **Automotive:**

Exhaust valves and components subjected to thermal cycles and elevated temperatures.

> **Aerospace:**

Components such as combustion chamber parts, high-temperature springs, and fasteners that require excellent thermal resistance.

Heat Treatment:

Alloy 80A can be heat-treated in various stages to optimize its mechanical properties for specific applications.

Heat Treatment Step	Heat Treatment Step	Duration
Solution Annealing	1050–1080	8 hours
Stabilizing Annealing	840–860	24 hours
Aging/Hardening	690–710	16 hours

Welding:

> **Welding Methods:** Alloy 80A can be welded by common techniques such as TIG, MIG, and electron beam welding.

> **Weldability:** Suitable for use in thin-walled applications, with special attention needed for thicker sections to prevent microfissuring.

> **Post-Weld Heat Treatment:** Required to restore mechanical properties and prevent issues such as reduced creep resistance.

Machining:

> **Machining Condition:** Machining should be done in the fully heat-treated condition to take advantage of the material's optimal hardness and strength.

> **Machining Techniques:** Precise and stringent machining techniques are required, as the alloy has a high tendency for cold working and strain hardening.

BILLET AND BAR PRODUCTS

Size Ranges

Billet and Bar
Diameters 0.5 in. to 15 in. (12.7 mm to 381 mm) and
weights up to ca. 22,000 lb. (10,000 kg)

Round Cornered Squares
4 in. to 14 in. (102 mm to 356 mm) across flats and
weights up to approx. 20,000 lb. (9,000 kg)

Hot Rolled Rod
Diameters 0.5 in. to 2.36 in. (13 mm to 60 mm) and lengths up to ca. 20 ft. (6 m).
Longer lengths on application

Hot Rolled Wire Rod
Diameters 0.217 in. to 0.59 in. (5.51 mm to 15 mm) in coil form

Cold Drawn Rounds
Diameters 0.5 in. to 4 in. (13 mm to 102 mm) and lengths up to approx. 32 ft. (10 m)

Cold Drawn Hexagons
0.5 in. to 4 in. (13 mm to 101.6 mm) across flats and lengths up to ca. 20 ft. (6 m)

Cold Drawn Wire
Diameters from 0.004 in. to 0.2 in. (0.2 mm to 5 mm) available in coil,
on reels and in “pay-off packs”

Ingot
Diameter up to 44 in.

TUBULAR PRODUCTS

Cold Worked Seamless Pipe and Tube
0.75 in. to 26 in. (19.1 mm to 660 mm) O.D. range
Hot Worked (Extruded) Seamless Pipe and Tube
3.5 in. to 8.625 in. (88.9 mm to 219.1 mm) O.D. range

FLAT PRODUCTS

Hot Rolled Plate
Thickness from 0.187 in. to 4 in. (4.76 mm to 102 mm) and
widths from 48 in. to 98 in.(1,220 mm to 2,500 mm)

Cold Rolled Sheet
Thickness from 0.008 in. to 0.25 in. (0.20 mm to 6.4 mm) and widths to 48 in. (1,219 mm)

Cold Rolled Strip
Thickness from 0.008 in. to 0.125 in. (0.20 mm to 3.2 mm) and widths down to 12.6 in. (320 mm)

Minimum Mill Quantities
Small batch quantities, 300 or 500 kg, can be offered for most bar & tube sizes,
for flat products, the minimum order quantity is 2 metric tons.

Ever Nickel Alloy Co., Ltd.

Tel: +86 0731 82250427
E-mail: sales@evernickel.com
Phone: +86 15308477503
Web: https://www.evernickel.com
Address: No.1 North, West Side of Xingda Avenue, Dainan Town, Xinghua City, Jiangsu, China

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