Alleima

Sanicro® 41

Billets

Datasheet

Sanicro® 41, commonly known as Alloy 825, is an austenitic corrosion resistant Ni-Fe-Cr alloy. It is characterized by:

- Excellent resistance to stress corrosion cracking in chloride and sour (H_2S/Cl^-) environments
- Excellent resistance to attack by acidic media such as sulfuric and phosphoric acid
- Better resistance to pitting and crevice corrosion compared to steels of the ASTM 316 type
- Good weldability

Standards

- ASTM: 825
- UNS: N08825
- W.Nr.: 2.4858
- DIN: NiCr 21 Mo
- BS: NA14

Product standards

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Suitable for production of flanges etc. according to ASTM B564

Certificates

Status according to EN 10 204 3.1

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr	Ni	Mo	Others
≤0.05	≤0.5	0.8	≤0.025	≤0.015	20	38.5	2.6	Ti=0.7 Cu=1.7 Al=0.1

Applications

Sanicro® 41 has good resistance to general and localized corrosion under diverse conditions. Applications can be found in chemical processing, oil and gas production, acid production, pickling operations and corrosive environments containing sulfuric acid, phosphoric acid, sulfur containing gases, oil wells and sea water.

Industrial categories	Typical applications
Chemical industry	Flanges
Food industry	Valves and discs
Petrochemical industry	Fittings
Pulp and paper industry	Couplings
Pickling equipment	Rings and seals
Oil & Gas industry	Bolts and nuts
Nuclear fuel reprocessing	Shafts
	Forgings
	Piping
	Pumps
	Tanks

Corrosion resistance

General corrosion

Sanicro® 41 possesses excellent resistance to corrosion. The material is clearly superior to standard molybdenum-alloyed steels such as AISI 316L, particularly when exposed to non-oxidizing media, such as sulfuric or phosphoric acid. The resistance to highly oxidizing agents, such as nitric acid, is also satisfactory.

Pitting and crevice corrosion

The resistance of Sanicro® 41 to pitting and crevice corrosion is superior to that of AISI 316 - a result of the higher chromium and molybdenum contents in the material.

Stress corrosion cracking

The high nickel content of the material promotes excellent resistance to stress corrosion cracking induced by both chlorides and alkalis. Sanicro® 41 has shown excellent resistant to stress corrosion cracking in sour environments.

Intergranular corrosion

Since the material is titanium-stabilized, the risk of intergranular corrosion is minimized.

For further information on corrosion resistance of Sanicro® 41, please see the datasheet - Seamless tube and pipe Sanicro® 41. The data should be considered in the knowledge that it may not be applicable for thick sections, such as forgings.

Forms of supply

Sizes and tolerances

Round-cornered square, as well as round billets, are produced in a wide range of sizes according to the following tables. Larger sizes offered on request.

Surface conditions

Square billets

Unground, spot ground or fully ground condition.

Round billets

Peel turned or black condition.

Square billets

Size	Tolerance	Length
mm	mm	m
80	+/-2	4 - 6.3
100, 114, 126, 140, 150	+/-3	4 - 6.3
160, 180, 195, 200	+/-4	4 - 6.3
>200 - 350	+/-5	3 - 5.3

Sizes and tolerances apply to the rolled/forged condition.

Peel turned round billets

Size	Tolerance	Length
mm	mm	m
75 - 200 (5 mm interval)	+/-1	max 10
>200 - 450	+/-3	3 - 8

Unground round billets

Size	Tolerance	Length
mm	mm	m
77 - 112 (5 mm interval)	+/-2	max 10
124, 134	+/-2	max 10
127, 147, 157	+/-2	max 10
142, 152, 163	+/-2	max 10
168, 178, 188	+/-2	max 10
183, 193	+/-2	max 10

Other products

- Seamless tube and pipe
- Hollow bars

Heat treatment

Billets are delivered in hot worked condition. The following heat treatment is recommended for finished products.

Solution annealing

930-980°C (1700-1800°F) followed by quenching in water.

Mechanical properties

Sanicro® 41 conforms to the required mechanical properties according to specification ASTM B564. Testing is performed on separately solution annealed and quenched test piece.

At 20 °C

Metric units

Proof strength	Tensile strength	Elongation
$R_{p0.2}$ [1)]	R_m	A
MPa	MPa	%
≥241	≥586	≥30

At 68 °F

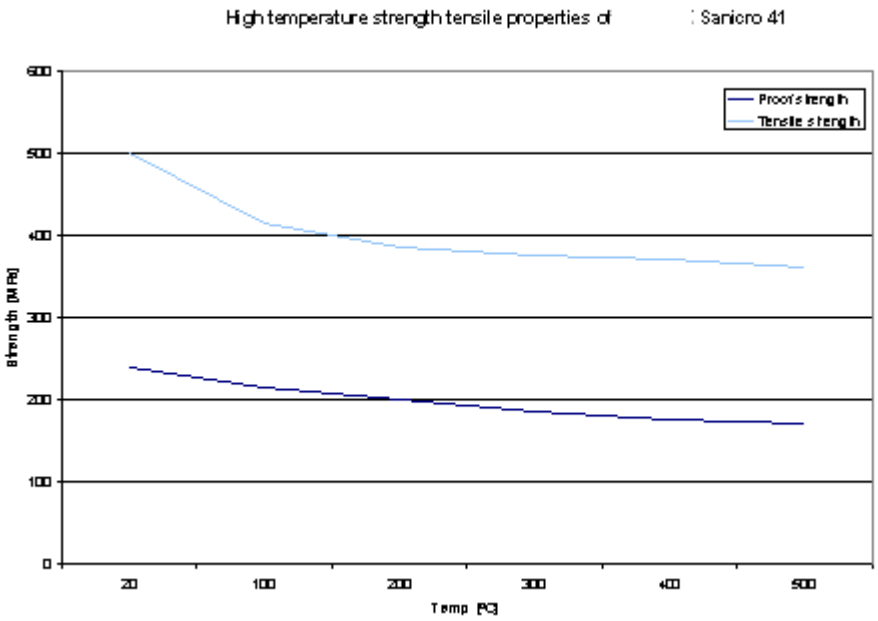
Imperial units

Proof strength	Tensile strength	Elongation
$R_{p0.2}$ [1)]	R_m	A
ksi	ksi	%
≥35	≥85	≥30

1) Corresponds to 0.2 % offset yield strength

At high temperatures

Fig. 1 shows indicative values for tensile strength properties of Sanicro 41 at high temperatures.



Physical properties

Specific heat capacity [1)]

Temperature, °C	J/(Kg °C)	Temperature, °F	Btu/(lb °F)
20	440	68	0.11

1) typical value

Thermal conductivity [1)]

Temperature, °C	W/(kg °C)	Temperature, °F	Btu/(ft h °F)
20	11	68	6

1) typical value

Thermal expansion [1)]

Temperature, °C	Per °C	Temperature, °F	Per °F
30-100	14.2	86-200	7.9
30-200	14.6	86-400	8.1
30-300	14.9	86-600	8.3
30-400	15.1	86-800	8.4
30-500	15.3	86-1000	8.5

1) typical values ($x10^{-6}$)

Hot working

The hot forming range for Sanicro® 41 is 900-1175°C (1740-2150°F), followed by quenching in water. Subsequent heat treatment should be carried out in accordance with the recommendations given for heat treatment.

Welding

The weldability of Sanicro® 41 is good. Suitable methods of fusion welding are manual metal-arc welding (MMA/SMAW) and gas-shielded arc welding, with the TIG/GTAW method as first choice.

Since the material has low thermal conductivity and high thermal expansion. Welding plans should therefore be carefully selected in advance, so that distortions of the welded joint are minimized. If residual stresses are a concern, solution annealing can be performed after welding.

For Sanicro® 41, heat-input of <1.0 kJ/mm and interpass temperature of <100°C (210°F) are recommended. A string bead welding technique should be used.

Recommended filler metals

TIG/GTAW or MIG/GMAW welding

ISO 18274 S Ni 8065/AWS A5.14 ERNiFeCr-1 (e.g. Exaton Sanicro 41 Cu)

ISO 14343 S 27 31 4 Cu L/AWS A5.9 ER383 (e.g. Exaton 27.31.4.LCu)

MMA/SMAW welding

ISO 14172 E Ni 8025, E Ni 8165

ISO 3581 E 27 31 4 Cu L R/AWS A5.4 E383-16 (e.g. Exaton 27.31.4.LCuR)

Machining

Machining Sanicro® 41, as with other stainless steels, requires an adjustment to tooling data and machining method, in order to achieve satisfactory results. Compared to Sanmac® 316/316L, the cutting speed must be reduced by approximately 55-60%, when turning Sanicro® 41 with coated, cemented carbide tools. Much the same applies to other operations. Feeds should be reduced by approximately 10-15% and with care.

Detailed recommendations for the choice of tools and cutting data are provided in the data sheet for Sanmac® 316/316L.

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