Duplex Stainless Steel 2205 (UNS S31803/S32205)

Duplex Stainless Steel 2205 offers superior corrosion resistance than other steel grades. It has high strength and easy fabricability properties. It excellently resists corrosion in brackish and marine water. 2205 steel prevents stress corrosion cracking and localized corrosion in oxidizing and reducing environments. It is commonly used in acid treatment tubes, pipes, heat exchanger parts, food processing, oil distillation plants, bleach washer, high chloride and marine water applications.

Its constituent's concentration has been changed by different steel manufacturers to obtain an enhanced corrosion resistance functionality. 2205 steel certainly cannot be used in the applications at high temperatures over 300oc because it develops precipitates of fragile micro parts.

Chemical Composition

Chromium (Cr)	22 to 23 %
Nickel (Ni)	4.50 to 6.50 %
Molybdenum (Mo)	3 to 3.50 %
Carbon (C)	0.030 %
Nitrogen (N)	0.14 to 0.20 %
Manganese (Mn)	2 %
Silicon (Si)	1 %
Phosphorous (P)	0.030 %
Sulfur (S)	0.020 %
Iron (Fe)	Rem %

Mechanical Properties

The high strength 2205 alloy provides superior fatigue strength. 2205 and 316 L steels are analyzed at the reverse bending stress at room temperature. The fatigue limit is close to the yield strength. In various cases, the fatigue strength interacts with the corrosion rate so

fatigue strength is reduced. In these conditions the duplex steel 2205 alloy provides valuable benefits over mild steel and conventionally formed stainless steel alloys.

Duplex stainless steel 2205 alloy offers excellent strength at the room temperature as well as sub zero temperature ranges. It can be stress relieved at 525oC to 600oC for one hour. The stress reliving of alloy widely contributes in enhancing its resistance to stress corrosion cracking.

Tensile Strength	621 Mpa
Yield Strength	448 MPa
Elongation	25 %
Hardness	31 Rockwell or 293 Brinell

Physical Properties

Density	782 kg/m3
Elastic modulus	190 MPa
Mean coefficient of thermal expansion	13.7 micro-meter/ meter/ oC from 0oC to 100oC
	14.2 micro-meter/ meter/ oC from 0oC to 315oC
Thermal conductivity	19 W/m.K
Specific heat	418 J/kg.K at 0 to 100oC
Electrical Resistivity	850 m-ohm.meter

Corrosion Resistance

Duplex stainless steel 2205 alloy offers extensive resistance to the local corrosion factors like intergranular, pitting and crevice corrosion. The CPT of duplex stainless steel 2205 alloy is minimum 35oC. It offers outstanding resistance to the chloride ion stress cracking at temperature ranges to 150oC. It offers enhanced performance in the conditions that cause rapid distortion of austenitic steels. It also offers excellent resistance to the sea water.

However, duplex 2205 alloy provides excellent resistance to oxidation at the elevated temperature it may suffer from embrittlement when kept at temperature over 300oC even for the short period. The embrittlement can be avoided by the complete solution annealing of steel 2205 meanwhile it should never be implemented in the temperatures above 300oC.

2205 steel is heat processed at temperatures between 1020oC to 1100oC and quenched quickly. The steel of this class should not be toughened by the heat processing and it should be work hardened.

Fabrication

Welding: 2205 steel is easily weldable by the common methods but it should not be welded in the absence of filler metal because it may produce ferrite phases. Since 1554.6 metal qualifies the welding of stainless steel 2205 alloy with the help of 2209 rods or electrodes that make sure that the metal has been deposited equally. The nitrogen is included as the shielding material to support in guarantee the sufficient austenite in the shape.

Machining: The input heat should be kept lower and pre or post heating is not essential. Minor coefficient of thermal expansion of duplex stainless steel as compare to the austenitic classes lowers the distortion and related stress levels. The large strength of alloy that makes it significant in various operations also decreases its machinability effectively. The cutting rate of alloy is almost 20% lesser than the stainless steel grade of 304 alloy

The large strength of **Duplex stainless steel 2205 alloy** makes the bending and production more typical such that for these processes the user needs high capacity system as compare to the requirement for other steel grades. The alloy's ductility is lesser than the austenitic class so intense operations like cold heating are not feasible. In case the outstanding cold processing of alloy is required it can be done by its moderate annealing.

As the use of **Duplex stainless steel 2205 alloy** at the high temperatures like up to 300oC is not recommended due to production of precipitates that together affect the material's property of resistance to corrosion. At the low temperature, the embritllement occurs due to precipitation of nitride, chloride and alpha. Although in the normal formation and manufacturing of steel alloy, the critical temperatures risks the embritllement and affects the resistance to corrosion property at the minor level. Moreover this doesn't affect the nature of **Duplex stainless steel 2205 alloy** in the operation temperature and is nominally considered in the measurement. For example the heat exchange vessels are used at the high temperatures without causing any troubles. The completely annealed and quenched processing helps to regain the hardness and strength of alloy.

Available Forms

Wire, Strip, Sheet, Plate, Foil, Bar, Rod, Pipe, Tubing, Flanges, Mesh