TECH ROCK S.L.

Material Description:

PLX High Corrosion Resistant

Fixe PLX

1- Physical properties

Ambient temperature physical properties for the new Fixe PLX are very similar to those of conventional austenitic stainless steels. Some typical properties are shown in the following table.

Density (kg/m^3)	Young's Modulus (GPa)	Specific Heat (J/kg K)	Electrical Resistivity (µΩ m)
7800	200	500	0,8

2- Mechanical properties

Fixe PLX is in general terms much stronger than conventional austenitic stainless steels, with yield and ultimate tensile strengths of the order of two times the ones of an average AISI 316L. Despite the increase in strength, the PLX still preserves good ductility properties, which makes it extremely tough.

Typical Yield Strength $Re_{0,2\%}$ (MPa)	850
Typical Ultimate Tensile Strength Rm (MPa)	950

3- Chemical composition requirements

Stainless steels are alloyed with Chromium and other elements to improve their corrosion resistance. Chrome oxidizes when exposed to the environment and creates a passive layer that protects the material. A minimum of about 11 % Cr content is considered necessary to form this passive layer.

Fixe PLX contains approximately double this amount of Cr, a minimum of 21%, and together with other elements like Nickel and Molybdenum, its resistance against many kinds of corrosion is significantly increased while preserving a good crystallographic structure. The following table shows the required chemical composition.

	C	P	S	Si	Mn	Cr	Ni	Mo	N
Minimum (%)	-	-	-	-	-	21,000	3,500	2,500	0,050
Maximum (%)	0,030	0,035	0,015	1,000	2,000	24,000	6,500	3,500	0,220

4- Corrosion resistance

Fixe PLX presents a better corrosion resistance than 304L and 316L stainless steels in most situations. There are some particular situations where the benefits over the traditional materials are clearly superior in this regard.

The PLX microstructure combines austenitic and ferritic structures thanks to the Nickel content. This makes the material far more resistant to chloride stress corrosion cracking than austenitic stainless steels such as 316L.

The high Chromium, Molybdenum and Nitrogen content makes the PLX very resistant to chloride-induced localized corrosion, which also helps to prevent stress corrosion cracking in aggressive environments.

After doing an extremely aggressive test with saturated sodium chloride solution at 120ºC, the tensile strength of the PLX material is around 300 N/mm^2, which is similar to the yield strength found on most conventional austenitic stainless steels not subject to those conditions. On the other hand, a 316L stainless steel under the same test shows a dramatic drop in tensile strength to less than 50 N/mm^2 (only around 5% of its yield strength).

Figure 1 shows these results.

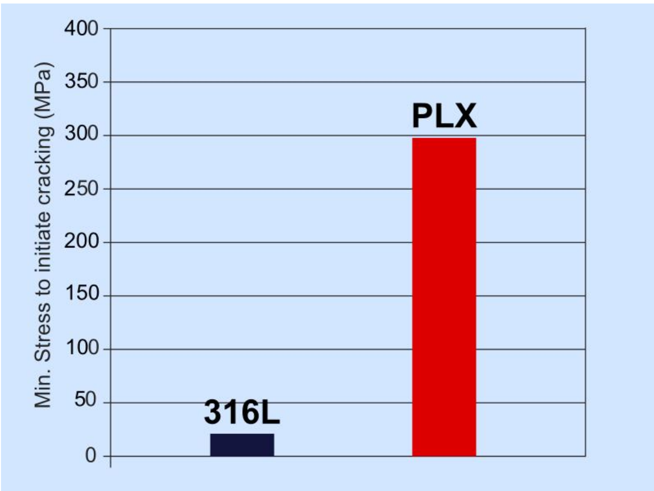

Figure 1: Stress that caused cracking in a drop evaporation test with sodium chloride solutions at 120ºC

The relatively high Chromium content improves the PLX resistance to acid induced corrosion. Figure 2 shows the loss of material per year in an acid solution due to corrosion versus the variation of the concentration of formic acid. For example, with a concentration of 15% of formic acid is around 0,04 mm per year for the PLX while for the 316L is nearly 0,25 mm per year.

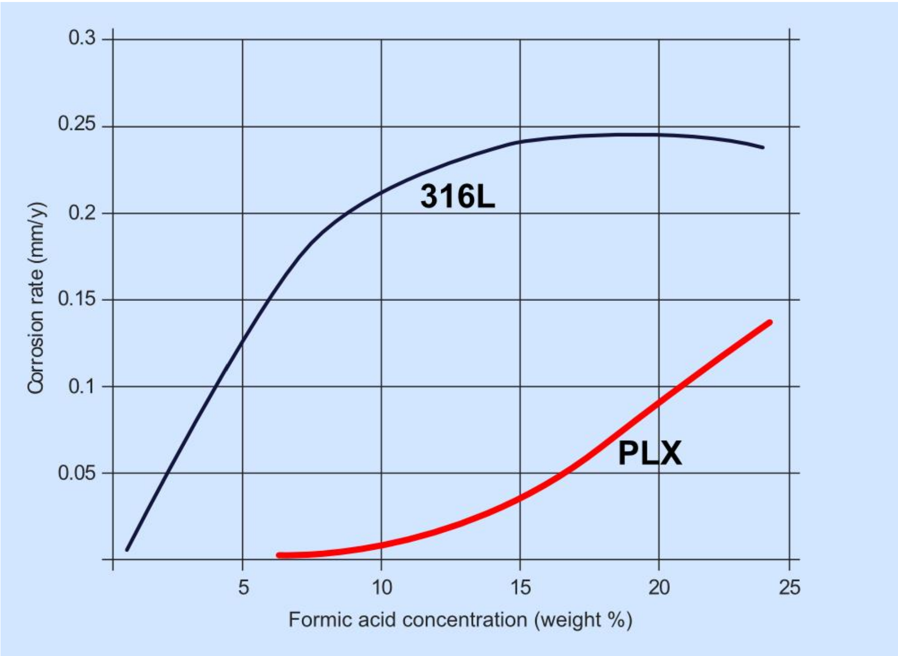

Figure 2: Comparison of corrosion rates for a 316L and Fixe PLX in a boiling 50% solution of acetic acid and varying concentrations of formic acid (Source: Sandvik)