

Choice of Steel Alloys for Sight Glass Construction

There has been some confusion about which steel alloy is best suited for the harsh environments common to sight glass installations. Because the value of an investment in equipment is amortized over its service life, the corrosion resistance of the metal used in sight glasses is important. This technical brief covers the steel alloys available, their characteristics, and their merits for sight glass construction.

Like other process equipment, sight glasses are made with stainless steel, in which oxidation (rust) is discouraged by adding 10 to 28 percent chromium content. Nickel content also contributes to oxidation resistance, as do other ingredients such as molybdenum and manganese. There are many different alloys and grades of stainless steel, and usually the equipment supplier standardizes on one alloy. Sometimes a supplier offers alternative alloys upon request, with a longer lead time.

Most stainless steel used in process equipment falls into the 300 Series, in which nickel has been added to the iron and carbon to encourage a crystalline-type structure called austenite. Another type of stainless steel, ferritic, is less durable but more corrosion resistant.

Duplex stainless steels have a mixed microstructure of austenite and ferrite. This gives duplex the best of both worlds: improved strength and resistance to corrosion compared to austenitic steel. Duplex steel has high chromium content, and up to five percent molybdenum. Duplex steels are extremely strong, and, despite low nickel content, offer superior corrosion resistance.

A report by metallurgist Dr. Ahluwalia documented the improved corrosion resistance, anti-pitting and resistance to chloride-stress cracking properties of duplex 2205 stainless steel, compared to 316L stainless steel.

The report states that “duplex steels have high chromium content, which is beneficial in oxidizing acids, along with sufficient molybdenum and nickel to provide resistance in mildly reducing acid environments.”

“In addition, duplex steels contain alloys that provide more resistance to chloride-stress cracking. The report points out that, according to ASTM G 48 test results (10 percent ferric chloride), the critical pitting and crevice corrosion temperatures for 2205 steel are well above those of 316L steel.”

Although austenitic stainless steels are useful for chemical and pharmaceutical equipment, duplex stainless steels provide equal or superior strength, and superior corrosion resistance to oxidizing chemicals. All but the lowest grades of duplex stainless steels provide superior corrosion resistance in chloride environments.

References

“Selection of Duplex 2205 over Stainless steel 316L,” Dr. Hira Ahluwalia, Material Selection Resources (www.doctormetals.com), 2006.

A nice review of the different types of stainless steel is available on wikipedia. http://en.wikipedia.org/wiki/Stainless_steel#Types_of_stainless_steel