

**AUSTENITIC STAINLESS STEEL WITH
HIGH RESISTANCE TO CORROSION BY
CHLORIDE AND SULPHURIC MEDIA AND
USES**

The present invention relates to an austenitic stainless steel with high mechanical strength and high corrosion resistance.

Stainless steels with high mechanical strength and high resistance to corrosion in chloride media and sulphuric media or even in media which are at the same time chloride-containing and sulphuric, are employed for the manufacture of equipment intended especially for the purification of fumes from thermal electrical power stations or intended for oil platforms working in contact with seawater and media containing acidic gases or else for the manufacture of paper pulp or for the chemical industry. These stainless steels are superaustenitic steels, austenoferritic steels or superaustenitic steels with a high nitrogen content. For these applications the superaustenitic steels with a high nitrogen content are the steels that offer the best performance in terms of a combination of mechanical characteristics and of corrosion resistance. They are described in two European Patents: EP-A-0,438,992 and EP-A-0,342,574.

However, these steels (described by EP-A-0,438,992 and EP-A-0,342,574) have disadvantages. On the one hand, while the improvement in the resistance of these steels to corrosion in a chloride medium is effective, the resistance of these new grades to corrosion in polluted or unpolluted concentrated sulphuric media is mediocre, with the result that the suitability of these steels for a multifarious utilization in various corrosive media or those containing different corrosive agents, for example chloride-containing and sulphuric media, is less good than that of previously known steels which, on the other hand, had poorer mechanical characteristics.

Furthermore, when the type of steel described by Patent EP-A-0,438,992 is employed for manufacturing thick components, phenomena of segregation or of precipitation of intermetallic phases appear during the manufacture of these components, and these very markedly deteriorate the mechanical properties, especially impact strength and corrosion behaviour.

The aim of the present invention is to overcome these disadvantages by providing a stainless steel with high mechanical characteristics and especially with an elastic limit higher than 400 MPa and with high resistance to corrosion in chloride media and sulphuric media which are pure or polluted and especially which has a pitting corrosion resistance value $PREN = \% Cr + 3.3\% Mo + 16\% N$ higher than 50, which has a very good suitability for multifarious use in various corrosive media containing different corrosive agents, for example chloride-containing and sulphuric ones, and which makes it possible to manufacture thick components which have a very good impact strength and corrosion resistance throughout.

To this end, the subject of the present invention is an austenitic stainless steel with a high mechanical characteristic and high corrosion resistance, whose chemical composition comprises, by weight:

$$20\% \leq Cr \leq 30\%$$

$$25\% \leq Ni \leq 32\%$$

$$3\% \leq Mo \leq 7\%$$

$$0.35\% \leq N \leq 0.8\%$$

$$0.5\% \leq Mn \leq 5.4\%$$

$$C \leq 0.06\%$$

$$Si \leq 1\%,$$

the remainder, with the exception of iron, consisting of impurities resulting from the production.

The carbon content is preferably lower than 0.04%. To improve its corrosion resistance, this steel may additionally contain from 0.5% to 3% of copper.

It is preferable that this steel should contain less than 0.010% of sulphur.

It may additionally contain at least one element taken from B, Nb, V, Al in contents which are: B from 0.0001 to 0.003%, Nb from 0.001 to 0.3%, V from 0.01 to 0.3%, Al from 0.001 to 0.1%.

This steel preferably contains:

$$23\% \leq Cr \leq 28\%$$

$$25\% \leq Ni \leq 28\%$$

$$4.5\% \leq Mo \leq 7\%.$$

Still more preferably, the composition of the steel according to the invention is the following:

$$25\% \leq Cr \leq 26\%$$

$$25\% \leq Ni \leq 26\%$$

$$6\% \leq Mo \leq 7\%$$

$$0.4\% \leq N \leq 0.5\%$$

$$2.5\% \leq Mn \leq 3.5\%$$

$$C \leq 0.03\%$$

$$Si \leq 0.3\%,$$

$$1\% \leq Cu \leq 2\%,$$

the remainder, with the exception of iron, consisting of impurities resulting from the production.

Finally, the chemical composition of the steel must preferably satisfy the following relationships:

$$95 < kP = \% Cr + 0.3\% Ni + 9\% Si + 27\% Mo + 130\% P - 8\% N < 232$$

and preferably:

$$95 < kP < 210$$

and

$$319 < kC = 3.3\% Cr + 10\% Ni + \% Mo + 1.5\% Cu < 432.$$

and preferably:

$$355 < kC < 432.$$

Another subject of the invention is the use of the steel according to the invention for the manufacture of equipment for removing pollutants from the fumes of thermal power stations and of plants for the incineration of household waste, especially gas or fume scrubbing towers, gas or fume ducts and chimneys; for the manufacture of equipment for delignification, especially by the bisulphite process, for filtration and for bleaching of paper pulp; for the manufacture of equipment for the chemical industry in a chloride or acidic medium and especially for the manufacture of vessels, storage tanks, reactors, pipes, pump bodies and pump shafts; for the manufacture of offshore platform equipment subjected to corrosion by seawater and/or hydrocarbons and especially flare supports, of heat exchangers, of separators, of tube plates, of pipework for conveying seawater, of pipework employed for conveying hydrocarbons, of components for protecting the regions of pylons situated in the vicinity of the free sea surface, of earth rods, of pump shafts, of connecting flanges, of wellheads, of manifolds and of risers; and for the manufacture of tankers for road or rail transport of highly corrosive chloride-containing or acidic products.

The invention will now be described more precisely but without any limitation being implied.

The austenitic stainless steel according to the invention must contain (contents expressed in % by weight):