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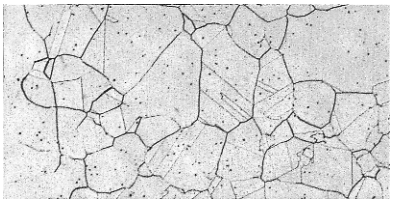
OVERVIEW OF STAINLESS STEELS

General Description of Stainless Steels

Stainless steels may be divided into five main groups, the first four of which are based upon a common crystalline structure of the steels within the group. The fifth group, known as precipitation hardening steels, consists of alloys that can be hardened by an aging treatment.

Austenitic Stainless Steels. Austenitic stainless steels containing chromium and nickel are given a 300 Series classification and austenitic steels containing chromium, nickel and manganese are given a 200 Series classification. It should be noted, however, that some austenitic stainless steels do not have these 200 and 300 Series designations. The steels in this austenitic group have many compositions and properties, but they have many characteristics in common. They can be hardened by cold working but not by heat treatment. In the annealed condition all are essentially nonmagnetic, but some may become slightly magnetic by cold working. In the annealed condition they have excellent formability.



Highly magnified crystalline structure of austenitic stainless steel

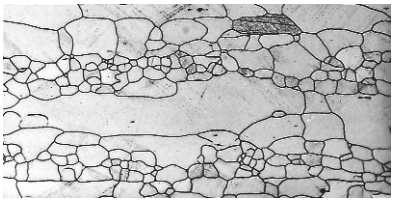
The various grades of austenitic steels have excellent corrosion resistance in many environments, resisting attack by the atmosphere and by many industrial gases and many chemicals. They have a resistance to scaling at temperatures as high as 2000°F (1095°C). The resistance of an individual austenitic alloy to corrosion or oxidation in a particular environment will depend upon that steel's alloy content.

Many of these steels have good strength at high temperatures which accounts for their wide use at elevated temperatures. They are also among the primary materials selected for use at extremely low temperatures since they do not become brittle as with other types of steel. All austenitic stainless steels are sensitive, to some degree, to chloride stress corrosion cracking and fully austenitic types may be sensitive to solidification cracking.

Some types are susceptible to carbide precipitation or intermetallic phase precipitation under adverse conditions of fabrication and use.

Type 304 stainless steel is the most widely used steel of the austenitic group. It has a nominal composition of 18% chromium and 8% nickel.

Ferritic Stainless Steels. Ferritic stainless steels are straight-chromium 400 Series steels that contain from 11 to 27% chromium and little or no nickel. They cannot be hardened by heat treatment and are only moderately hardened by cold working. These steels are magnetic. They have moderate ductility and resistance to corrosion and oxidation.



Highly magnified crystalline structure of ferritic stainless steel

Ferritic stainless steels are relatively weak at high temperature, and in heavier sections they may be lacking in toughness at below ambient temperatures.

Type 430 is the general purpose steel of the ferritic group. It has a nominal composition of 17% chromium and is used for highly-polished trim applications in mild atmospheres. It is also used in food processing and for consumer goods.

Type 409 and its recently-standardized variations are the most widely used ferritic grades of all the nickel-free stainless steels. They are among the least expensive of all stainless steels. These grades have a nominal composition of 11% chromium and their major use is in automotive exhaust systems.

Martensitic Stainless Steels. Martensitic stainless steels, like the ferritic steels, are straight-chromium types in the 400 Series. They have from 11 to 18% chromium with or without small additions of nickel or other elements. These steels are magnetic.

Unlike the austenitic and the ferritic steels, the martensitic steels are hardenable by heat treatment and are generally used in the hard ened and tempered condition.