INFLUENCE OF CHEMICAL ELEMENTS IN STEEL

Aluminum AL - melting point 650 °. It is a powerful deoxidizer of steels. Combined with nitrogen, reduces the susceptibility of steel aging, because of strain. In small additions, prevents the growth of steels' grains. Hardens the ferrite.

Boron B - melting point 2040 ° C. Increases the depth of hardened layer and the hardness of the core, of the tempered steels. In the austenitic stainless steels increases the elastic limit, decreasing the corrosion resistance.

Carbon C - melting point 3737 ° C. It is the main element of alloy in steel. By definition, "Steel is the iron-carbon alloy containing generally between 0.008 to 2.0% of weight carbon. "The carbon is combined with iron, forming the cementite, which formula is Fe3C. While the pure iron is quite malleable, the cementite is very hard. Therefore, we can say that the main property conferred by the carbon to steel is hardness.It also increases, the maximum tensile strength and hardenability, but decreases toughness and weldability.

Cobalt Co - melting point 1492 ° C. Increases resistance to tempering, thermal conductivity and greatly increases the residual magnetism, also increasing the limit of resistance in hot traction .It is not a element that forms carbides.

Cr Cromo – ponto de fusão 1920º C. Elemento que favorece a formação de carbonetos em um aço. Por conseguinte, aumenta a dureza e a resistência à tração do aço. Aumenta, também a temperabilidade e em grandes quantidades a resistência à corrosão, mas diminui um pouco a tenacidade e bastante soldabilidade. Em média, o limite de resistência à tração aumenta 8 a 10 kg/mm² com adição de 1% de Cr, mas a resistência ao impacto diminui.

Copper Cu - melting point 1084 ° C. Improves endurance limits of traction and yield strength of steel, but decreases elastic properties. In small quantities, makes the steel rust resistant.

Hydrogen H - melting point 262 ° C. Undesirable element, because weakens the steel, and decreases elasticity ,without increasing the limit of flow or limit of tensile strength. May cause the defect called "flakes".

Molybdenum Mb - melting point 2610 ° C. It increases the resistance to hot, and in the presence of nickel and chromium, increases the limit of traction resistance and yield strength. Molybdenum difficults forging and improves hardenability, resistance to fatigue and magnetic properties. Exerts considerable influence on the properties of solder. It is a formative element of carbides. In quick action, increases the toughness while maintains the properties of hot hardness and retention of court. In the high speed steels, substitutes the tungsten for the formation of carbides, in the proportion of 1% of molybdenum to 2% of tungsten.

Mn Manganese - melting point of 1244 ° C. Increases hardenability, weldability and the limit of tensile strength, with insignificant decrease in tenacity. Manganese combines in first place with sulfur to form the corresponding sulfide (MnS), the exceeded part combines with carbon, giving carbide (Mn3C), compound similar to cementite (Fe3C), to which is associated, and partly diffuses in the ferrite. The cementite contains variables levels of Mn3C. In large quantities and in the presence of carbon, it greatly increases the abrasion 's resistance. Manganese is a powerful deoxidizer.

N Nitrogen - melting point 210 ° C. Harmful to low steel alloys, because it decreases the toughness and causes intergranular corrosion. In austenitic stainless steels,the nitrogen stabilizes the structure, increases the hardness and the yield strength.

Niobium Nb - It's a very interesting element when you want high mechanical strength and good weldability.Very low levels of this element increases the endurance limit and limit drain. Promotes grain refining. It is a component almost mandatory in high strength steels and low alloy.Besides not harming weldability, allows the reduction of carbon and manganese, improving therefore the weldability and toughness.

Ni Nickel - melting point 1453 ° C. It gives to the steel, a large penetration of temper, because it reduces the speed critical cooling. Nickel, when connected to chromium increases toughness of steel benefited. In large amounts, along with chromium, makes the steel resistant to corrosion and heat. It has direct influence in the grain becomes finer. It's not a formative element of carbides.

P Phosphorus - melting point 44 ° C. It is an undesirable impurity. Damaging to the quality of steel as it increases the tendency to segregation. However, it is found in all steels, as a consequence of contamination of raw material. Quality steels have always specifications for the maximum permitted percentage of phosphorus, which is around 0.05%.

Pb Lead - melting point 327 ° C. When added at levels from 0.15% to 0.50% due to its fine and homogeneous distribution in steel, it results in the formation of thin and short chips, improving machinability without affecting the mechanical properties.

S Sulfur - melting point 118 ° C. It exists in all steels as impurity. The permitted levels are oup to 0.05%. Steels resulfurized admit high levels of sulfur and manganese, combined in the form of manganese sulfide (a compound plastic), facilitates the machining.

Se Selenium - melting point 217 ° C. It is used in the same way that the sulfur to improve machinability of steel, having the advantage of presenting more effective results, besides increasing corrosion resistance in stainless steels.

Si Silicon - melting point 1410 ° C.It raises the yield strength resistance of steels. Affect the elongation, tenacity, thermal conductivity and machinability. Reduces the formation of carbides because, somehow, it helps the decomposition of cementite in ferrite. Is practically impossible to have a steel-free silicon, since, it's found in iron ore, is also found in refractory materials of furnaces, where it is absorbed in the melting process. A steel can be classified as silicon steel , only when the content of this element is more than 0.40%. Silicon steels have good ability to temper, as they have critical cooling rate.

Ti Titanium - melting point of 1812 ° C. Added in small amounts has the task of refining the grain. In certain stainless austenitic steels, titanium is added to well-defined relationships with the carbon steel to stabilize against the formation of carbides chromium in the grain boundary.

V Vanadium - melting point 1730 ° C. Small additions of vanadium increase the hot hardness and reduce the grain size. In the high speed steel, vanadium improves teh cutting retention, increases the limit of tensile strength and yield strength. From the point of view of carbides formattion, it replaces the molybdenum in the proportion of 1% of molybdenum to 2% vanadium, and tungsten in the proportion of1% of vanadium to 4% og tungsten.

W Tungsten - melting point 3380 ° C. It increases the limit of tensile strength, abrasion resistance and hot hardness, but reduces the thermal conductivity of steel. Used in high speed steel, the tungsten improves the retention of cutting. It is a formative element of carbides.