

## Heat resistant materials

The construction engineers put higher demands on the refractory lining and so that refractory materials have to fulfill these demands. The materials have to be more resistant against high temperature, chemical attack by hot gases or in case of cooling below the dewpoint with the consequence of the attack by aggressive aqueous solutions.

The different factors which affect negatively on the metallic anchoring elements mainly find expression on corrosion and embrittlement.

## Corrosion

Corrosion is the surface changing of a metallic material caused by unwanted chemical or electrochemical reaction which affect negatively on the characteristics of the material and their environment. For the choice of material the alloy-type, the structure and the surface character have influence on the corrosion resistance and the corrosion process. The environment has a strong effect on the corrosion, for example the flow speed, the concentration of the gases and fluids and the temperature. The strict reaction of metal with another reactant is called chemical corrosion. This kind of oxidation process happens most in temperatures higher than 700 °C and is normally called oxidation.

Electrochemical corrosion is a reaction between two kinds of metal or metal with aqueous mediums. This process is called rusting.

## Embrittlement

Not only the factor corrosion can have a negatively influence on the endurance of metals. Under certain environment conditions the matrix of the metal can change with the consequence of a negative effect on the durability of the metal.

### 475 °C Embrittlement

On long-term heating of chromium steels (> 12% Cr) in a temperature range from 400 – 500 °C, the steels become brittle.

### Sigma phase embrittlement

In steels with > 13% chromium, the sigma phase embrittlement can arise in a temperature range from approx. 600 – 900 °C. The incurrence of intermetallic phases might happen which decrease the positive attributes of the chromium. The result of these phases is a reduction of heat resistance and brittleness.

## Carburization

In certain mediums carbon atoms might react with the alloy and result in carburization. This means a higher cohesiveness and a reduction in the ductility with the effect of embrittlement.

The endurance and the application temperature of the material depend on the operating conditions. The application temperature written down in technical literature is only guilty for the usage in hot air, provided that the mechanical strain is irrelevant.

We have to caution against using the materials higher than these application temperatures because generally the usage is in other atmospheres than hot air. In these cases the speed of oxidation of the steels and alloys might rise heavily with the result that the application temperature is up to 200 °C less than it would be in hot air.

## Heat resistant steels and alloys

The AS Schöler + Bolte GmbH has a lot of heat resistant materials in different dimensions in their warehouse. The standard materials are listed in the following chart "Data of alloys". If other types of alloys are inquired they can also be delivered on demand. The marking of the steels go according to the agreement of the customer and the supplier. The chart "comparison of standards" shows the relationship between the different country norms.