

ALLOYS FOR HIGH TEMPERATURE APPLICATIONS

- continued

See www.multialloys.co.za/teknitalk for preceding issues



Oxidation.

In the section dealing with the role of the alloying elements (July 2009) the phenomena of oxidation was introduced and the following are some of the salient points:

- Oxidation is the reaction of the metal with oxygen to form an oxide layer.
- A protective (dense) and adherent oxide layer retards the attack and can be created by alloying element additions chromium, aluminium, silicon and rare earths.
- Thermal cycling, particularly rapid temperature changes, are detrimental as they can result in spalling of the protective layer. Again alloying can assist in reducing the negative effect of temperature cycling and nickel plays a role in this regard.
- There are a few elements that form liquid and even gaseous oxides and thus their presence in the metal may lead to catastrophic oxidation. Molybdenum should be avoided in metals for service above 750 deg c and similarly for niobium. Tungsten is reported to be both beneficial and deleterious!! Lead and vanadium also form liquid oxides.

From what we have reviewed in this series on high temperature alloys thus far it should be evident that it is often necessary to make tradeoffs in the design and selection of alloys. Aluminium may be desirable for the oxidation resistance it confers but it may embrittle the alloy; Mo, W and Nb can be used to strengthen the alloy but in some instances there may be the downside of reduced oxidation resistance.

Sulphur Attack

Sulphur attack is similar to oxidation in that it represents the reaction of sulphur with the elements in the metal. The origin of the sulphur may be in the flue gas or the process gas and the rate of the attack may be influenced by the oxidizing potential of the gas. In general terms the scales which form in the presence of sulphur are less protective but more importantly is the fact that many sulphides have low melting points. This is specifically the case for nickel. Nickel and nickel sulphide form a compound which melts at low temperatures. Thus the alloy may be observed to be melting at temperatures way below that which would normally be expected !! It is not unknown for an expensive nickel alloy to fail prematurely and suddenly because of this unexpected interaction between nickel and sulphur with the latter having its source in something such as the cutting fluids used in machining

Our next **Seminar** will be in March or April and should you be interested in attending please send an e-mail to kenp@wwtrade.co.za.

These Seminars are held at our premises in Kyalami, are free of charge and run from 9h00 to 16h00.

Over the years attendees have found these a valuable way of learning more about a niche range of metals - high alloy and duplex stainless steels, nickel alloys and titanium

Dial 0860ALLOYS

Tel: +27 11 466 2480. Fax: +27 11 466 1692

Email: kenp@wwtrade.co.za / Website: www.multialloys.co.za