

## Adding Value Through Experience

July 2009

## ALLOYS FOR HIGH TEMPERATURE APPLICATIONS - continued

*This is the third in a series of notes on Alloys for High Temperature Applications.  
See - [www.multialloys.co.za/teknitalk](http://www.multialloys.co.za/teknitalk) for the preceding 2 issues*

### ROLE OF THE ELEMENTS - RESISTING CORROSION

Two criteria for selecting an alloy for high temperature service are  
- can it resist attack in the environment at the temperature?  
- does it possess the strength for the application?

We address the first of the criteria in this month's TEKNITALK

In practice there may be one or more mechanisms of high temperature corrosion that take place simultaneously. The nature of these are such that the degradation may be in the form of both loss of the metal at the surface as well as internal ( sub-surface) attack predominantly along grain boundaries.

Oxidation, the reaction of oxygen with one or more of the elements in the metal, is the most common form of high temperature attack and preventing or retarding this in iron and nickel based alloys is achieved by the addition of chromium in the first instance. In some cases aluminium and/ or silicon may be added as well. These 3 elements readily form a protective oxide layer on the surface of the alloy and hence are often referred to as "scale formers". The effectiveness of the oxide layer will depend on a number of factors including the oxygen activity, other elements present in the gas and the operating temperature. The aim is to form an adherent and dense layer without it continuing to grow rapidly.

The addition of Rare Earth Metals ( eg Lanthanum and Cerium ) has been found to improve the oxidation resistance of alloys by reducing the oxide layer growth rate further.

It is worth noting that cyclic heating and cooling and the associated expansion and contraction of the alloy may result in the oxide layer spalling off thereby exposing a new surface to attack. In this way metal degradation can be significant even though this may not be anticipated at the operating temperature.

To be continued

Our first Seminar for 2009 was again well received and as has been the case over the years, attendees found it a valuable way of learning about a niche range of metals

We discuss corrosion and heat resisting alloys  
- high alloy and duplex stainless steels, nickel alloys and titanium.

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

Our next Seminar will be late in August or October ( to be confirmed) and should you be interested in attending, please send an e-mail to [kenp@wwtrade.co.za](mailto:kenp@wwtrade.co.za)

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