

Adding Value Through Experience

April 2010



ALLOYS FOR HIGH TEMPERATURE APPLICATIONS - CONTINUED

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

Carburisation, Nitridation and Metal Dusting.

The iron and chrome present in high temperature alloys, even in a "simple" stainless steel such as 310, results in the formation of carbides and nitrides if these grades operate at high temperatures in atmospheres containing carbon and nitrogen. The intentional addition of carbon and nitrogen into steel as a means of surface hardening is common practice but the uncontrolled absorption of these elements can be deleterious. The formation of carbides and nitrides will result in a reduction of toughness specifically at room temperature, and in situations where thermal cycling occurs, cracking can easily result.

The depletion of alloying elements in the vicinity of the precipitates will result in reduced corrosion resistance at these points as is the case with the intergranular corrosion (aqueous) phenomena. Of course these problems are more pronounced with higher levels of carbide and nitride formers whilst the presence of nickel and copper improve the resistance of the alloy.

Metal dusting is a very specific form of corrosion which takes place in the presence of carbonaceous gasses such as may exist in the heat treatment and the petrochemical industries including coal to - liquid and gas to liquid plants. This form of corrosion is still subject to extensive research and alloy development has been spurred on by the magnitude of the problem and the potential of these new technologies.

A simple "model" for metal dusting, which may differ slightly for iron and nickel based alloys, is:

- 400 to 800 deg C is the critical temperature range
- Carbon diffuses into the metal and carbides form.
- The metal becomes saturated with carbon or carbides and powdery carbon forms as a continuous layer.
- This results in metal particles and the carbides "falling out" of the metal surface, leaving behind shallow pits.

To resist metal dusting, alloys need to be able to form an adherent, healable, protective layer although current research indicates that the presence of copper in the alloy aids in preventing the ingress of carbon in the first place. Whilst many of the newer alloys targeted at the petrochemical industry are "proprietary", the older established alloys such as ALLOY 330 or DS have been used successfully in the heat treatment industry.

to be continued

SEMINARS: Unfortunately we were not able to hold a Seminar in March or April as planned but as soon as we can re-schedule the next one we will promote it as we have done in the past. Alternatively, you may want to indicate your interest ahead of time by mailing kenp@wwtrade.co.za

Dial 0860ALLOYS

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

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