ABSTRACT

Information on the stress corrosion behaviour of the duplex weld metal of austenitic stainless steels on high temperature ageing is not available and the data on the mechanical properties are few and far between. Hence this work was undertaken to systematically correlate the effect of transformation of delta ferrite on high temperature ageing with the observed changes in the mechanical and stress corrosion property at an ageing temperature of 873 K.

The transformation of delta ferrite increased with increasing ageing time. At lower ageing times, the delta ferrite to austenite + carbide reaction was dominant and at higher ageing times, the reaction of delta ferrite transforming to sigma was dominant. The transformation was diffusion controlled. Small quantities of R - phase and chi phase were also detected.

Stress relieving and depletion of alloying elements as a result of precipitation of the various intermetallic phases from delta ferrite, caused softening of the austenite matrix at ageing times upto 200 hours and beyond that, matrix hardening as a result of significant amount of sigma phase precipitation, was observed. These two competitive effects governed the response of the weld metal to its tensile properties in liquid paraffin and in boiling 45 % magnesium chloride at 427 K. A general improvement in the tensile and stress corrosion properties were observed upto 200 hours of ageing and a degradation was noted thereafter.

In magnesium chloride, the weld metal was found to fail by a combination of TGSCC of austenite and interface cracking in the CERT as well as the constant load tests.