

Influence of thermal ageing on the mechanical and corrosion properties of the Super Duplex 1.4410 (UR™2507)

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SuperDuplex stainless steels are more and more used in the Oil & Gas industry, especially in refining and petrochemical applications. Many equipment operating at high temperatures are of concern: vessels, heat exchangers, machinery pumps, applications in polymers units. Thermal ageing of duplex stainless steels can lead to the formation of detrimental phases that can dramatically decrease the corrosion and mechanical properties of these materials.

For this reason, pressure vessels design codes provide upper temperature limits in the range from 250°C to 315°C depending on the chemical composition of the duplex grade. ASME code limits the use of 2507 to 315°C, VdV TÜV to 250°C.

However, only little data is available in the literature on the influence of ageing on the properties of super-duplex stainless steels.

This presentation will deal with the impact of various thermal ageing conditions on the properties of the duplex 1.4410 (25%Cr, 7%Ni)

Thermal ageing in the range from 250 to 450°C during 200 to 1100 hours were considered. For each thermal condition, the mechanical properties of the material were evaluated by means of tensile and Charpy tests. The objective was to highlight the influence of the heat treatment on the yield strength, ultimate tensile strength and toughness properties of the grade. In addition, corrosion tests were carried out in chloride-containing media to assess the pitting resistance of the material.

Special attention was paid to the evolution of the microstructure of the grade as a function of the thermal ageing conditions. An original approach based on the monitoring of the Thermo Electric Power associated with Atomic Tomographic Probe measurements were implemented, to characterize the evolution of the microstructure. Alpha prime phase was clearly pointed out.

Based on these data, this presentation will provide a mapping of the mechanical and corrosion properties of the super-duplex 1.4410 as a function of the ageing temperature and ageing duration. These data will be correlated with the presence of detrimental phases, highlighting the safe domain of use of the grade.

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