

## Phase transformation and mechanical behavior in annealed 2205 duplex stainless steel welds

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### Abstract:

The phase transformations and mechanical behaviour during welding and subsequent annealing treatment of 2205 duplex stainless steel have been investigated. Detailed microstructural examination showed the presence of higher ferrite amounts in the heat affected zone (HAZ), while higher amounts of austenite were recorded in the centre region of the weld metal. Annealing treatments in the temperature range of 800–1000 °C resulted in a precipitation of  $\sigma$  phase and  $M_{23}C_6$  chromium carbides at the  $\gamma/\delta$  interfaces that were found to be preferential precipitation sites. Above 1050 °C, the volume fraction of  $\delta$  ferrite increases with annealing temperature. The increase of  $\delta$  ferrite occurs at a faster rate in the HAZ than in the base metal and fusion zone. Optimal mechanical properties and an acceptable ferrite/austenite ratio throughout the weld regions corresponds to annealing at 1050 °C. Fractographic examinations showed that the mode of failure changed from quasi-cleavage fracture to dimple rupture with an increase in the annealing temperature from 850 to 1050 °C

**Keywords** : duplex stainless steel, welding, Annealing, microstructure, impact toughness, tensile tests