

## Effect of solution treatment temperature on the precipitation kinetic of $\sigma$ -phase in 2205 duplex stainless steel welds

Riad BADJI, M. BOUABDALLAH, B. BACROIX, C. KAHLOUN, Khireddine BETTAHAR,  
Nabil KHERROUBA  
Welding and NDT Research Center (CSC), BP 64, Cheraga, Algeria

### Abstract:

The effect of the prior solution treatment temperature on the  $\delta$ -ferrite transformation in 2205 duplex stainless welds after aging at 850 °C has been studied. Microstructural examination showed that the  $\sigma$ -phase and  $M_{23}C_6$  chromium carbides precipitate at the  $\delta/\gamma$  interfaces and within the  $\delta$ -ferrite grains. Increasing the solution treatment temperature from 1050 to 1250 °C delays the  $\sigma$ -phase formation and favours the precipitation of intragranular secondary austenite  $\gamma_2$ . The simulation of the  $\sigma$ -phase precipitation kinetic in the base metal, HAZ and weld metal, indicates a good agreement between the experimental fitted data and the modified Johnson–Mehl–Avrami model. The results indicate a marked sensitivity of the  $\sigma$ -phase precipitation kinetic to the solution treatment temperature. A high precipitation rate corresponds to a fine grained structure with ferrite enriched in  $\sigma$  forming elements (Cr, Mo)

**Keywords** : duplex stainless steel, welding, ageing, precipitation kinetic, Johnson-Mehl-Avrami model