

Influence of isothermal aging in LDX 2101 duplex stainless steel on the microstructure and local properties

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Abstract: In the present work, the interface morphology and the evolution of nitride precipitates in LDX 2101 stainless steel isothermally treated at 750 °C for various aging times were investigated. The microstructure results showed that the Cr₂N nitrides precipitated along the γ/γ' interface with 200 nm in length and continue to grow to 2 μ m after 240 h of aging. However, only Cr₂N nitrides were found at the γ/γ' interface after long term of aging. Atomic force microscopy (AFM) analysis revealed that Cr₂N nitrides and Cr₂₃C₆ carbides started to precipitate after the first 10 min of aging with a small needle shape of the former and specific triangular morphology of the latter. The evolution of hardness and Young's modulus of the interfaces, performed with nano-indentation measurements, showed that the γ/γ' interface became harder (4.1 ± 0.2 GPa) with increasing aging times, whereas negligible changes in the hardness and elastic modulus were recorded at the γ/γ'' interface. 3D topographic analysis of the immersed surfaces revealed that the susceptibility of γ phase to preferential dissolution in 3.5% NaCl solution increased with aging time. This behavior was manifested by the important imperfections of γ phase, the high surface roughness (55.7 nm), and the deep corrosion pits (30 nm) along the γ/γ' interface and around the Cr₂N nitrides.

Keywords : microstructure, Interface, precipitates, Nano-hardness, Surface degradation