

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 α/α' 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 α/α' 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 α/α' 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 α/α' interface. 3D topographic analysis of the immersed surfaces revealed that the susceptibility of α' phase to preferential dissolution in 3.5% NaCl solution increased with aging time. This behavior was manifested by the important imperfections of α' phase, the high surface roughness (55.7 nm), and the deep corrosion pits (30 nm) along the α/α' interface and around the Cr₂N nitrides.

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