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Microstructural and mechanical characterization of aged and restored 2205 duplex stainless steel

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Abstract : Duplex stainless steels (DSS) with ferritic-austenitic microstructure offer good combination of resistance to pitting corrosion and high strength that are not attainable using conventional single phase such as austenitic or ferritic stainless steels. The DSS used in this investigation was SAF 2205 alloy having a stable microstructure consisting of about 48% ferrite and 52% austenite at ambient temperature. In order to investigate aging and restoration behavior of this steel and the influences on mechanical properties, aging treatments at 850°C (after annealing at 1080°C and 1120°C) were conducted for various times: 30, 60, 90 and 120 min. At last, an annealing treatment was carried out to, for all specimens, at 1080°C for 60min in order to dissolve any precipitates and to restore the γ - α phases balance of the 2205 duplex stainless steel. Specimens were subjected to impact testing and hardness measurements before and after all treatments. Finally the changes in microstructure due to aging and restore treatments were studied by optical and electronic microscopy. The results showed that aging treatment had negligible effect on hardness. Besides, considerable changes in term of precipitation of harmful intermetallic particles were observed in microstructure during thin aging which led to a significant decrease in toughness and notable increase in hardness. The formation of intermetallic phases such as σ was recognized as the major reason for the observed changes

Keywords : duplex stainless steel, aging, Restoring, Toughness, sigma Phase