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Influence of cold deformação on the short duration low temperatura aging of superduplex stainless steel UNS S39274

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Superduplex Stainless Steels (SDSS) are a kind of Fe-Cr-Ni-Mo alloys with the microstructure composed by approximately 50%/50% ferrite/austenite phases, with low carbon content (<0.03%), and nitrogen addition. These features contribute to the good mechanical properties and corrosion resistance of these materials. UNS S39274 is a W-alloyed SDSS used in critical services in the Exploration and Production of the Oil & Gas Industry, such as in Oil Country Tubular Goods (OCTG), i.e. tubullars designed to withstand high pressure (until 138MPa), temperatures until 250oC and corrosive environments (with CO2 and H2S). In order to achieve a high mechanical strength the seamless tubes are cold drawn in a costly operation. The ferrite phase of superduplex steels is susceptible to phase transformations at high and low temperatures, such as sigma, chi, Cr2N and ?' formation. The prolonged use or aging between 280oC and 550oC may provoke the spinodal decomposition of the ferrite phase into Cr-rich ?' and Cr-depleted ?'' nanosized phases. The consequences of the long duration aging are the excessive hardening, embritllement and corrosion decay of the steel. On the other hand, short duration aging treatments may be used to increase hardness and mechanical resistance with little harmful effects on the other properites. This work was focused on the investigation of short duration aging at 400 and 475oC of the UNS S39274 steel comparing two initial conditions: (i) cold drawn and (ii) annealed. This way was also possible to study the effect of work hardening on the low temperature formation of ?'. The steel was aged for periods up to 12h. The effects on mechanical properties (hardness, tensile and impact toughness) and pitting corrosion resistance were determined. The activation energy for precipitation was obtained through differential scanning calorimetry (DSC), and the results indicate a significant reduction with the cold deformation.