

Effects of Tensile Pre-Stresses on Corrosion Behavior of AISI 304 Stainless Steel in 1N H₂SO₄

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Abstract : The aim of this work is to assess the influence of tensile pre-stresses on the microstructure and corrosion behavior of the AISI304 stainless steel in 1N H₂SO₄ austenitic stainless steel. Samples of this stainless steel either with pre-stresses, corresponding to [255, 305, 355, 405, 455, 505, 555, 605 and σ_f] MPa induced by tensile tests, or without pre-stresses (as received), were characterized regarding their microstructure to investigate the pre-tensile stress effects on the corrosion behavior. The results showed that the corrosion rate of elastic pre-stresses 304 stainless steel was very little increased compared with that of as received specimens. The corrosion rate increases after applying pre-stress between ($\sigma_{255} - \sigma_{455}$) MPa. The microstructure showed that the austenitic grains begin to deform in the direction of applied pre-stresses. The maximum hardness at this region was (229.2) Hv, but at higher pre-stress ($\sigma_{455} - \sigma_{605}$) MPa unanticipated occurrence, the corrosion rate decreases. The microstructure inspection shows the deformed austenitic grain and α -martensitic phase needle are appeared inside austenitic grains and the hardness reached the maximum value (332.433) Hv. The results showed that the corrosion rate increases at the values of pre-stresses between ($\sigma_{605} - \sigma_f$) MPa., which is inspected the result. The necking of gauge length of specimens occurs in specimens and this leads to deterioration in original properties and the corrosion rate reaches the maximum value.

Keywords : tensile pre-stresses, corrosion rate, austenitic stainless steel, hardness

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