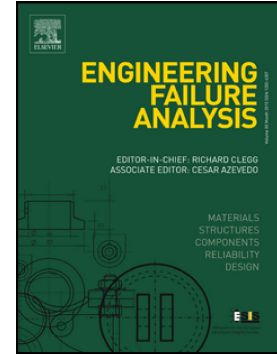


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Damage associated with the interaction between hydrogen and microstructure in a high sulfur 17-4PH steel for studs

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**Damage associated with the interaction between hydrogen and microstructure in a
high sulfur 17-4PH steel for studs**

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Abstract

A great number of failure cases of precipitation hardenable 17-4 PH steels have been described in the literature. Structural components working in harsh environments failed due excessive hardness. A maximum hardness of 33 HRC was specified for service in aggressive media. However, high impurity levels and chromium carbide precipitation may cause failure, even when the correct final heat treatment is applied and the hardness is below the maximum limit. This fact is investigated in this work, where a 17-4PH steel with 0.027%S was evaluated after hydrogen cathodic charging. Specimens with three different commercial heat treatments were evaluated. Specimens with treatments A (solution treated) and H900 (aged for the peak of hardness) showed inter and transgranular microcracks, pores and cracks associated with sulfide inclusions. Specimen with treatment H1150 (overaged), with low hardness, experienced intergranular attack and pores nucleation in the inclusions. The high sulfur steel was also more susceptible to pitting corrosion, which can also contribute to the hydrogen embrittlement process in high chloride solutions. It is recommended to limit the sulfur and other impurities contents to values lower than those specified by the usual standards.

Key-words: Precipitation hardenable stainless steel, hydrogen embrittlement, sulfides.

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