Hydrogen Embrittlement in WELDOX 1300 and HARDOX 500

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Abstract

Upon trying to reach higher strengths, when designing steels, inevitably susceptibility to one type of cracking known as hydrogen cracking increases. In present work, this complexity with regard to high strength structural steel of Weldox 1300 and wear plate of Hardox 500 was studied.

Effect of low temperature tempering (200℃) and hard leveling on hydrogen embrittlement was qualitatively explored by fracture toughness testing. Tests were performed on *SENB* specimens of two types of Weldox 1300 in air and 3.5% *NaCl* solution. *In-situ* testing of as-quenched Weldox caused *K* value for crack growth initiation to drop to almost 20% of that for reference specimen tested in air. However, Weldox 1300 in tempered and leveled condition exhibited considerably improved resistance against hydrogen cracking by almost 50% compared to as-quenched condition. It is believed that formation of transit carbides acting as strong traps due to tempering, and alteration in dislocations' structure and level of tensile residual stresses thanks to combined effects of tempering and leveling have considerable impact on crack growth kinetics which results in improved resistance. The influence of tempering and leveling was not investigated separately.

Additionally, by using four-point-bending test it was attempted to screen a method suitable for study of hydrogen embrittlement. Test variables were tried to be adjusted to meet the failure criteria. Precharged samples were subjected to bending stresses and left in outdoor atmosphere. Hydrogen measurement after passing 41 days on one of the samples containing a stress concentrator showed that hydrogen had been trapped and still present into the sample. Although hydrogen measurement showed the effect of stress fields on hydrogen trapping, test results along with *FEM* simulation indicated that such a test method might not be practicable for this special combination of materials and expectations.