Hydrogen Effects on Mechanical Behaviors of SA508 Cl.3 Pressure Vessel Steel at High Temperature

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Abstract

In order to investigate hydrogen effects on environmentally assisted cracking (EAC) of SA508 Cl.3 pressure vessel steel, tensile tests and fatigue crack growth rate (FCGR) tests were carried out at 288 °C with hydrogen-charged specimens. From results of the tensile tests, it was found that the charged hydrogen gave rise to some softening and ductility loss. Fracture surface observations of the hydrogen-charged specimens indicated some flat regions. These results can be explained that such softening may be induced due to the shielding effect, strain localization by dynamic strain aging (DSA), and internal pressurization. In the FCGR tests, crack growth rate of the hydrogen-charged specimen was increased by 2~3 times of that of as-received specimen at the same loading condition. Further, the fracture morphology of the hydrogen-charged specimen revealed a striationless cleavage-like feature with few secondary cracks. Through the test results described above, it may be considered that the hydrogen in materials can be involved in the occurrence of the EAC.