Effect of pre-strain on critical conditions for hydrogen-induced delayed cracking and crack nucleation characteristic of DP1180 steel

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Abstract: Hydrogen-induced delayed cracking (HIDC) represents a significant threat to the dependable performance of automotive steel. In this study, in-situ hydrogen charging constant load tensile tests were employed to measure the critical conditions for HIDC. The threshold stress values were obtained through the relationship between applied stress and fracture time, as illustrated in Fig. 1a. The assessment of the safe service area was determined by observing whether fracture occurs in the specimens within the specified time of 200 h, as shown in Fig. 1b. The objective of this work is to measure the specific critical conditions for HIDC of DP1180 steel plate [1] and establish the relationship between pre-strain, threshold stress, and critical hydrogen concentration, as shown in Fig. 1c. Additionally, we also measured the critical conditions for HIDC of another QP1180 steel plate [2] and investigated the effects of microstructure hydrogen distribution characteristics on HIDC [3-5]. These findings provide valuable references for the safety assessment of high-strength automotive steels in hydrogen-exposed environments.

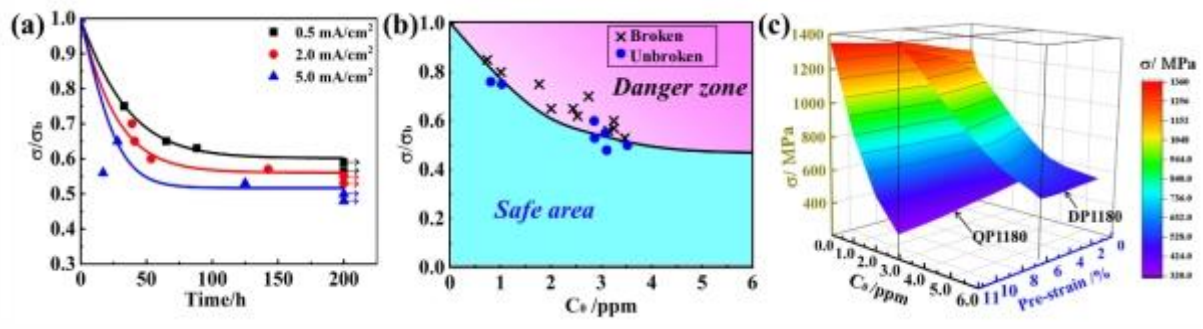

Fig. 1 (a) Relationship between applied stress and fracture time. (b) Relationship between applied stress and hydrogen concentration of the broken and unbroken specimens. (c) Relationship between the pre-strain, threshold stress, and critical hydrogen concentration.

Keywords: DP1180; Hydrogen-induced delayed cracking; Dislocation slip transfer;

Hydrogen distribution; Pre-strain.

Reference:

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