

## Study on the distribution of hydrogen and cracking behavior of X80 steel under electrochemical hydrogen charging

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**Abstract** In order to further understand the hydrogen-induced cracking mechanism of X80 steel, the distribution of hydrogen atoms in the steel after electrochemical hydrogen charging was characterized by hydrogen microprinting test (HMT) and scanning kelvin probe force microscopy (SKPFM), the hydrogen embrittlement sensitivity of X80 steel was studied by dynamic hydrogen charging slow strain rate tensile test (SSRT), and the tensile fracture and secondary cracks were observed by scanning electron microscope (SEM) and Electron Back Scatter Diffraction (EBSD). The results showed that after electrochemical hydrogen charging, hydrogen atoms were enriched at the grain boundaries, and the hydrogen embrittlement sensitivity of X80 steel increased with the increase of hydrogen charging current density. Hydrogen-induced cracks mainly initiated at the grain boundaries and preferentially propagated along the grain boundaries. At low current density, the mechanism of hydrogen-induced cracking is mainly hydrogen enhanced local plasticity model (HELP), and at high current density, it is mainly hydrogen enhanced decohesion mechanism (HEDE).

**Keywords** X80, electrochemical hydrogen charging, hydrogen distribution, hydrogen induced cracking

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