

Experimental study on mechanical properties degradation of TP110TS tube steel in high H₂S corrosive environment

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Summary

The research on casing corrosion in sour environment by a synergism of sweet corrosion and H₂S corrosion has become the basis of casing selection and casing string safety evaluation with more and more sour reservoirs containing high H₂S concentration being developed. It is essential to scientifically utilize casing service ability and reasonably control production rate of gas well to achieve the effective and safe developing of gas resources during the safety period of casing service with a precise casing life prediction. Scanning electron microscopy and tensile testing were applied to investigate the corrosion of TP110TS tube steel in stimulant solution with carbon dioxide (CO₂) and hydrogen sulfide (H₂S) at variable conditions of PCO₂/PH₂S, temperature and time. This paper especially focused on the degradation of mechanical properties (elastic modulus, yield strength and tensile strength) of test specimens subjected to corrosion. Experimental results suggest that the fracture mode will transit from ductile fracture before corrosion to brittle fracture after corrosion and the mechanical properties will experience obvious degradation when the specimens were exposed to corrosive environment. Service life prediction model of casing was established on the basis of experimental observations and results.

