Effect of Temperature on Corrosion Behavior of X65 Steel in Simulated Deep Sea Environment

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The influence of temperature on the corrosion behavior of X65 steel under simulated abyssal conditions have been investigated using electrochemical methods, Raman spectroscopy and 3D microscopy. EIS results indicated that the R_{ct} (charge transfer resistance) decreased gradually and the film density of the corrosion layer decreased with increasing temperatures. Polarization curves indicated that the corrosion current densities increased and the self-corrosion potentials shifted negatively with increasing temperatures. The corrosion morphology manifested that the dense corrosion product films were formed at lower temperatures with pitting corrosion occurring, whilst the corrosion product films had cracks at higher temperatures and the corrosion of X65 steel featured uniform corrosion. The results of Raman spectroscopy showed that the corrosion products were comprised of γ -FeOOH and Fe_3O_4 at 5°C, while they contained γ -FeOOH and α -FeOOH at 25°C. Therefore, the corrosion resistance properties of X65 pipeline steel in abyssal environments decreased as temperature increased.

Keywords: X65 pipeline steel, deep sea environments, temperature, hydrostatic pressure.

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