Corrosion Evolution of a Concrete/Casing Steel in Simulated Formation Water under Different CO₂ Partial Pressures

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doi: 10.20964/2020.10.40

Received: 11 June 2020 / Accepted: 1 August 2020 / Published: 31 August 2020

The corrosion behavior, mechanical properties, and microstructural evolution of a concrete/P110 casing steel system were studied in a simulated, CO₂-saturated formation water under different CO₂ partial pressures. It has been found that the corrosion and mechanical properties of the cement and the cement/casing interface were affected by both cement hydration and CO₂ corrosion, making the performance of the cement matrix and the interfacial transition zone improve initially and then deteriorate with time. The corrosion resistance of the casing steel reduced with increasing the immersion time and CO₂ pressure. The degradation of cement and cement/casing interface was aggravated under the high CO₂ pressure, which assisted the formation of a defected corrosion product layer (predominantly Fe_xCa_{1-x}CO₃) and led to severer corrosion on the casing steel surface.

Keywords: Steel; CO₂; Corrosion; EIS; Interfacial transition zone

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