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Abstract

The presence of oxygen in the wellbore is a serious issue and influences the corrosion behavior of the material by changing the morphology and properties of the formed corrosion layers. In this study, the effect of the dissolved oxygen concentrations on the corrosion behavior of 1Cr carbon steel and 13Cr stainless steel was investigated.

Tests were conducted at atmospheric pressure in 3.5 wt.% NaCl solution saturated with CO2 at two different temperatures, 40 ◦C and 80 ◦C for aerated and deaerated systems. Three different concentrations of dissolved oxygen (230 ppb, 650 ppb, and 2000 ppb) at 40 ◦C were studied. Linear Polarization Resistance (LPR), Electrochemical Impedance Spectroscopy (EIS), and Potentiodynamic Polarization were used to study the electrochemical behavior. X-Ray Powder Diffraction (XRD), Scanning Electron Microscopy (SEM), and Energy Dispersive X-Ray Spectroscopy (EDS) were employed to analyze the morphology, the chemical composition and the different phases of the corrosion products. Results showed that the corrosion rate of 1Cr carbon steel decreased with increasing the concentration of dissolved oxygen from (230 ppb to 2000 ppb) in the system. On the contrary, the polarization resistance of 13Cr stainless steel decreased with increasing the concentration of dissolved oxygen in the system, which implies a higher corrosion rate.

Keywords

Carbon steel; CO2 corrosion; Iron carbonate; EIS; LPR