Role of HCO_3^- and Cl^- in the Pitting of 20CrMo Steel in simulated oil field environment

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In this study, the effects of HCO_3^- and Cl^- concentrations on the pitting behavior of 20CrMo steel were investigated by potential polarization curve, electrochemical impedance spectroscopy and Mott-Schottky measurements. In addition, the concentrations of HCO_3^- and Cl^- in a simulated oil field environment were varied to investigate the interactions between HCO_3^- and Cl^- . The results indicated that with increasing HCO_3^- concentration, the passivation of HCO_3^- is enhanced, leading to the increase in the corrosion and pitting potentials and decrease in the number of defects in the passivation film as well as the corrosion current. With increasing Cl^- concentration, the erosion became severe, resulting in the loosening and breaking of the passivation film as well as the easy formation of holes. The $[\text{Cl}^-]/[\text{HCO}_3^-]$ ratio exhibited a concentration threshold. The passivation of HCO_3^- played a dominant role below the critical value; the erosion effect of Cl^- is main role above the critical value and 20CrMo steel occurs dissolution.

Keywords: 20CrMo steel; pitting corrosion; polarization curve; passivation film

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