Corrosion Studies of Carbon Steel Immersed in NACE Brine by Weight Loss, EIS and XRD Techniques

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Weight loss and corrosion rate measurements were determined by the immersion of the carbon steel for 24 hours in NACE brine; varying the rotation speed (200, 1000 and 2000 rpm) and the temperature (35, 50 and 65 °C). At this immersion time, the steel interface was further characterized by Electrochemical Impedance Spectroscopy technique (EIS), using the rotating cylinder electrode configuration. It was observed an increase in the oxidation of the steel by influence of the rotation mainly at temperatures of 50 and 65 °C; the corrosion rates increase from 25.99 to 110.52 and 45.2 to 135.27 mpy, respectively. This active oxidation is evident in the EIS characterization recording a shrinkage of the complex plots as the rotation and temperature were enhanced. According to the EIS analysis the electrochemical responses are governed by the oxygen diffusion process through the corrosion products under the influence of the electrode rotation. Using XRD analysis, the iron compounds formed by oxidation - precipitation after the immersion are mainly composed by magnetite (Fe₃O₄) and feroxyhyte (δ-FeOOH), respectively; being the feroxyhyte partially removed by the rotation favoring the active dissolution of the steel.

Keywords: Corrosion, EIS, brine, RCE

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