Effect of Fe ion concentration on fatigue life of carbon steel in aqueous CO2 environment - DTU Orbit (09/11/2017)

Effect of Fe ion concentration on fatigue life of carbon steel in aqueous CO2 environment

In this work, the corrosion fatigue behaviour of steel armours used in the flexible pipes, in aqueous solutions initially containing different concentrations of Fe^{2+}, was investigated by four-point bending testing under saturated 1 bar CO_2 condition. Corrosion fatigue results were supported with ex situ measurements of Fe^{2+} and pH. Characterisation of the corrosion scales and crack formations was performed using microscopic and diffraction techniques. Fatigue results showed two times better fatigue life, at the stress ranges of 250 MPa, for samples tested in solutions containing the concentration of Fe^{2+} marginally above the solubility limit of $FeCO_3$ compared to the samples tested in highly supersaturated solution of Fe^{2+}. Results revealed that the impact of the alternating stresses on the corrosion behaviour of samples reduces with lowering the applied stresses. At the stress range of 100 MPa, fatigue samples experienced the same corrosion rate as samples that were not subjected to dynamic loading.

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