Evaluation of Corrosivity of Produced Fluids during SAGD Operations
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Heavy oil extraction using steam flooding methods such as Steam Assisted Gravity Drainage (SAGD) has been used for several decades; yet no severe corrosion damage has been reported despite the presence of 35-40 mol. % CO2 and 2-3 mol. % H2S in the steam chambers. As acid gas partial pressures, pH and temperature traditionally drive corrosion control philosophies, this lack of observed corrosion does not align with conventional wisdom. Thermodynamic modeling (using OLI Analyzer suite) has been done to obtain related pH profiles and estimate carbon steel corrosion rates, in order to better understand the corrosive behavior exhibited by produced fluids under SAGD conditions. The results of the modeling suggests that the corrosivity of produced fluids is very low despite the relatively high acid gas content. This can be explained by the formation of a “passive” layer of iron oxide products (Fe2O3/Fe3O4) that is present primarily due to two factors: high temperatures (above ca. 130°C) which reduce acid gas solubility and partitioning of the gases primarily into the oil phase. These modeling results are also substantiated by weight loss and electrochemical testing experiments performed in simulated SAGD conditions. The likelihood of Pitting corrosion is also being assessed in this study by means of attrition rate modeling.

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