

Danish Offshore Technology Centre
Technology Conference 2022

Effect of impurities on corrosion behavior of L80-1Cr steel as well tubing material for CO₂ storage applications

Avinash Ingle, Sajjad Bahrebar, Kapil Kumar Gupta, Rajan Ambat*

Section of Materials and Surface Engineering, DTU Construct, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

**aviin@dtu.dk*

Abstract

Carbon capture and storage (CCS) is used to limit global warming and associated environmental impact. Defunct oil wells have great potential to be used for carbon dioxide (CO₂) injection and storage. Carbon steel (L80-1Cr) pipelines are most widely used in oil and gas as well tubing material. Corrosion occurs on the steel tubing during the injection and storage of CO₂, especially due to the contaminations in the CO₂ such as water, H₂S, SO₂, NH₃, O₂ and other substances. Hence, understanding the corrosion behaviour of well tubing material is important for providing long-term safe storage. However, allowable concentrations of various impurities in CO₂ are not yet fully determined. In this work, L80-1Cr was exposed to an aqueous CO₂-saturated solution with varying concentrations of different impurities at different temperatures of 5, 30 and 60°C in order to simulate CO₂ conditions after injection in CCS applications. The corrosion rate was determined using conventional electrochemical and standard weight loss measurements. Inductively coupled plasma optical emission spectroscopy (ICP-OES) analysis was used to determine the amount of Fe ions dissolved in the solution. Both the electrochemical measurements and weight loss indicate that the corrosion rate depends on the impurity level and temperature with a sharp increase observed from 5 to 60°C indicating accelerated corrosion kinetics at higher temperature.