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Gupta, Kapil Kumar; Ambat, Rajan

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Corrosion of L80-1Cr with ferritic-pearlitic microstructure: Initiation and growth under CO2 conditions

Kapil Kumar Gupta[a], Rajan Amba[t]
Section of Materials and Surface Engineering, Department of Mechanical Engineering, Technical University of Denmark, 2800 Lyngby, Denmark,
[a]kkgup@mek.dtu.dk

Corrosion of production tubing used for Oil and Gas application is a big challenge. Despite using various mitigation techniques (e.g. inhibitors), the most commonly used material in sweet condition (L80-1Cr) is susceptible to extensive corrosion, which results in increased operational expenses. It has been reported [1] that CO2 corrosion is influenced by operational parameters (pH, temperature, flow velocity, etc) and Metallurgical parameters (materials chemistry and microstructure). Studies [2] showed that material aspects such as alloy chemistry, microstructure, and surface finish define the properties (such as adherence) of the formed scales and thus have a significant effect on corrosion. In particular, the amount, size, and distribution of the cementite phase are important aspects in connection with corrosion and protectiveness of the formed scale [3]. Although studies have been performed to understand the corrosion mechanism and formation of scales, there is a lack of direct proof in terms of initiation and propagation of corrosion in correlation to the phase distribution.

Investigation in this paper focuses on determining the corrosion initiation and initial propagation of the corrosion on low alloy steel with ferritic–pearlitic microstructure in carbon dioxide-saturated solution. L80-1Cr material was subjected to a heat treatment (Heating to austenitizing temperature and then furnace cooled) to produce ferritic-pearlitic microstructure. The heat-treated samples were immersed in carbon dioxide-saturated 3.5% NaCl solution. Microstructure, surface chemistry, and surface morphology before and after immersion were investigated using Laser Optical Microscopy, Scanning Electron Microscopy (SEM), and X-ray photoelectron spectroscopy (XPS). The surface properties of the material were determined using SKPFM and SECM.

[1] L. T. Popoola, A. S. Grema, G. K. Latinwo, B. Gutti, and A. S. Balogun, “Corrosion problems during oil and gas production and its mitigation,” *Int. J. Ind. Chem.*, vol. 4, no. 1, p. 35, 2013.

[2] ASM International, Ed., *ASM handbook*, 10th edition. Materials Park, Ohio: ASM International, 1990.

[3] M. Ko, B. Ingham, N. Laycock, and D. E. Williams, “In situ synchrotron X-ray diffraction study of the effect of microstructure and boundary layer conditions on CO 2 corrosion of pipeline steels,” *Corros. Sci.*, vol. 90, pp. 192–201, Jan. 2015.