World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:11, No:02, 2017

Comparative Studies of the Effects of Microstructures on the Corrosion Behavior of Micro-Alloyed Steels in Unbuffered 3.5 Wt% NaCl Saturated with CO2

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Abstract : Corrosion problem which exists in every stage of oil and gas production has been a great challenge to the operators in the industry. The conventional carbon steel with all its inherent advantages has been adjudged susceptible to the aggressive corrosion environment of oilfield. This has aroused increased interest in the use of micro alloyed steels for oil and gas production and transportation. The corrosion behavior of three commercially supplied micro alloyed steels designated as A, B, and C have been investigated with API 5L X65 as reference samples. Electrochemical corrosion tests were conducted in an unbuffered 3.5 wt% NaCl solution saturated with CO₂ at 30 ⁰C for 24 hours. Pre-corrosion analyses revealed that samples A, B and X65 consist of ferrite-pearlite microstructures but with different grain sizes, shapes and distribution whereas sample C has bainitic microstructure with dispersed acicular ferrites. The results of the electrochemical corrosion tests showed that within the experimental conditions, the corrosion rate of the samples can be ranked as CR_(A)< CR_(X65)< CR_(B)< CR_(C). These results are attributed to difference in microstructures of the samples as depicted by ASTM grain size number in accordance with ASTM E112-12 Standard and ferrite-pearlite volume fractions determined by ImageJ Fiji grain size analysis software.

Keywords : carbon dioxide corrosion, corrosion behaviour, micro-alloyed steel, microstructures
Conference Title : ICEMC 2017 : International Conference on Electrochemical Methods in Corrosion
Conference Location : Paris, France
Conference Dates : February 23-24, 2017