The Formation of Sulfide Scales on Carbon Steel in Saturated H_2S

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Abstract

There are three contributing elements of corrosion of Carbon Steel in H_2S environment: the effect of H_2S on water chemistry; electrochemical reactions of the bare iron surface (both anodic and cathodic processes); and the formation and growth of corrosion product layers. The electrochemical reaction commonly contains three stages: first, the reactant transported from the solution (bulk) to the metal surface; then the transfer of the charge reaction on the surface, followed by the reaction product transported away from the iron surface to the bulk solution or the formation and development of the corrosion product which then can decrease the corrosion rate. Development of a robust corrosion model to predict the corrosion process in H_2S these requires a mechanistic understanding of all these elements.

An experimental study was carried out to assess the corrosion of C-steel under open-circuit technique conditions and in solutions at several ranges of time and temperatures. The effect of film composition, morphology, structure, thickness, and ion- concentration of corrosion product films formed on pipeline Carbon Steel in an acid sour solution were examined. The electrochemical behavior of the filmed steel was measured, and the film properties assessed using a range of advanced techniques including Scanning Electron Microscopy (SEM), and Raman spectroscopy (RS). The data will be discussed in terms of film formation mechanisms.

Recent Publications (minimum 5)

1. N. Al-Qahtani, J. Qi, Aboubakr M. Abdullah, N. J. Laycock, and M. P. Ryan, “Nanoscale Studies of Scale Formation in Sour Environments”, NACE -CORROSION 2018, in Sour Corrosion, (Houston, TX: NACE, 14-19 April 2018), Document Number C2018-11136.
2. Noora Al-Qahtani, Jiahui Qi, Aboubakr Abdullah, Nick Laycock, Mary Ryan, “Sulfide Scaling and Corrosion of Carbon Steel in a Sour Medium” in 232nd ECS Meeting in National Harbor, MD, USA (October 1-5, 2017).
3. Noora Al-Qahtani, Jiahui Qi, Nick Laycock, Aboubakr M. Abdullah, and Mary Ryan, “Sulfide Scaling and Corrosion of Carbon Steel in Oil and Gas Pipelines” in Proceedings of the 5th International Gas Processing Symposium (GPS 2016), held in Doha, Qatar from the 28th to 29th of November 2016. http://gpc.qu.edu.qa/gpc_symposium/2016/
4. Noora Al-Qahtani, Jiahui Qi, Nick Laycock, Aboubakr M. Abdullah, and Mary Ryan, “Sulfide Scaling of Carbon Steel in Sour Environment” in QU Annual research Forum 2017, held in Doha, Qatar from 3-4 May 2017.
5. Noora Al-Qahtani, Jiahui Qi, Nick Laycock, Aboubakr M. Abdullah, and Mary Ryan, “Sulfide Scaling and Corrosion of Carbon Steel in Oil and Gas Pipelines” in Shell-Imperial Research Showcase: Poster Display and Networking Lunch with Shell's CTO and Shell Leadership Team, held in UK 9th September 2016.

Biography

Noora Al-Qahtani joined Qatar university in 2008, and she is currently a Research Associate, Center for Advanced Materials at the Qatar University. She is also in a final year in her PhD study at a department of material science and engineering at Imperial College London-UK. Noora earned her MSc. from the University of Sheffield in 2015, in Materials Science and Engineering. She is also introducing higher-level research among high school students to promote the young researcher towards scientific education. She also authored numerous peer-reviewed journals and conference papers. Her current research focus in areas of applied electrochemistry and corrosion, and educational research for young students. In addition, her interests encompass archaeology from a scientific aspect. She is a member of the Institute of Materials Mining and Minerals from 2015 and a member of the NACE International-The Worldwide Corrosion Authority and Electrochemical Society (ECS) from 2015. Noora is also the Co-team leader of the Al-Bairaq whose vision is to develop Qatar as a knowledge-based society, enriching its human capital through prioritizing the importance of forging links and building bridges between high school students and educational institutions. Over the years she has been actively involved in Teaching, Research along with Admin works in various capacities.

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