

## The influence mechanism of cathodic polarization, stress, and mixed bacteria on the corrosion behavior of X80 steel

**Qi Fu**<sup>1, 2, \*</sup>, Guang-Ling Song<sup>1, 2, \*</sup>, Jin Xu<sup>3</sup>, Cheng Sun<sup>3</sup>

<sup>1</sup>*Department of Ocean Science and Engineering, Southern University of Science and Technology, Shenzhen 518055, China*

<sup>2</sup>*The University of Queensland, School of Mechanical and Mining Engineering, Division of Materials Engineering, St Lucia, Qld 4072, Australia*

<sup>3</sup>*Institute of Metal Research, Chinese Academy of Sciences, Shenyang, 110016, China*

Presenter's e-mail address: [15303927931@163.com](mailto:15303927931@163.com)

[\\*songgl@sustech.eud.cn](mailto:songgl@sustech.eud.cn), [guangling.song@hotmail.com](mailto:guangling.song@hotmail.com)

**Abstract** In the actual soil environment, the pipelines are subject to the combined action of SRB and NRB, and will inevitably be affected by stress during service. However, the corrosion mechanism of X80 steel under elastic stress and yield stress with the coexistence of SRB and NRB remains unclear. In addition, the effect of mixed bacteria and stress on the corrosion behavior of X80 steel under traditional cathodic protection, has not been reported. Therefore, we conducted in-depth research on the above-mentioned issues. It was found that in the inoculated environment, microorganisms and yield stress synergistically accelerated the corrosion of X80 steel, and the most serious damage resulted when SRB was involved. SRB and yield stress together led to the formation of secondary pits on the specimen surface. However, if mixed with NRB, the pitting degree of X80 steel surface was weakened, indicating that addition of NRB could inhibit the stress corrosion caused by SRB. After applying cathodic polarization, pitting pits were still found in the inoculated group. With the negative shift of the cathodic potential, the uniformity of corrosion damage was reduced, but the pitting was intensified.

**Keywords** X80 pipeline steel; Sulfate reducing bacteria; Nitrate reducing bacteria; Mixed bacterial corrosion; Stress corrosion