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Corrosion of metals and alloys — Test method for microbiologically influenced corrosion of oil and gas transmission pipelines

Corrosion des métaux et alliages — Méthode d'essai pour la corrosion microbiologique des canalisations de transport de pétrole et de gaz

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC156, *Corrosion of metals and alloys*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Microbiologically influenced corrosion (MIC) refers to corrosion caused by the presence and activities of microorganisms (e.g. bacteria, archaea and fungi). Although microorganisms do not produce unique types of corrosion, they can accelerate corrosion reactions and increase the susceptibility of materials to corrosion processes such as pitting, embrittlement and under deposit corrosion (UDC). MIC has been identified as a contributor to rapid corrosion of metals and alloys exposed to seawater, crude oil, hydrocarbon fuels, soils and sewage. In recent years, the oil and gas industry, especially pipelines, are suffering from severe MIC threats. It is estimated that approximately 20 % of pipeline incidents are related to MIC.

This document establishes a microbiological corrosion test method applicable to oil and gas transmission pipelines to facilitate microbiological corrosion test evaluation by oil and gas industry users and product suppliers. In this document, the total immersion corrosion test is used to determine the corrosion rate (including uniform corrosion rate and pitting corrosion) of metals and alloys. In particular, the test conditions (e.g. strain source, test solution and corrosive gas), procedures and results are regulated in detail. This document focuses on the internal microbial corrosion environment of oil and gas transmission pipelines, but it also applies to environments involving microbial corrosion risks such as water injection and downhole in the oil and gas industry.

Corrosion of metals and alloys — Test method for microbiologically influenced corrosion of oil and gas transmission pipelines

1 Scope

This document specifies a laboratory test method for microbiologically influenced corrosion (MIC) of oil and gas transmission pipelines, including the principle, apparatus, sources of strains, solutions, specimens, sterilization, procedure, results and report.

This document applies to the MIC test of metals and alloys for internal surfaces of oil and gas transmission pipelines.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8199, *Water quality — General requirements and guidance for microbiological examinations by culture*

ISO 8407, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 11463, *Corrosion of metals and alloys — Guidelines for the evaluation of pitting corrosion*

ISO 20391-1, *Biotechnology — Cell counting — Part 1: General guidance on cell counting methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
abiotic
test solution without living organisms, their biological components or the metabolic activities of living organisms

3.2
archaea
prokaryotic single celled organisms which lack cell nuclei and are morphologically similar to *bacteria* (3.3) but radically different in molecular organization, with eukaryote-like metabolic pathways and enzyme production

EXAMPLE 1 Methanogens are a group of archaea which are involved in microbiologically influenced corrosion (MIC)by consuming hydrogen at the metal surface and, hereby, creating a depolarization process. Methanogens are common in oil production systems, but they are normally not measured with current culturing techniques.

EXAMPLE 2 Sulfate-reducing archaea is a group of anaerobic archaea that reduce sulfate and result in sulphide formation. They are most likely to grow at reservoir conditions (60 °C to 95 °C).