Laboratory Evaluation of Corrosion Inhibitors Used in the Oil and Gas Industry

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Foreword

This AMPP technical report was prepared to provide basic information on laboratory evaluation of corrosion inhibitors used in the oil and gas industry. It describes the types of oil and gas industry corrosion inhibitors and how their properties are evaluated for oil and gas field applications. These field applications include oil and gas production, gas processing, transportation, and produced water re-injection. This report provides 18 inhibitor properties that are generally evaluated prior to a field application. A brief description of these selected properties' evaluation techniques, along with associated ASTM[(1)] and ISO[(2)] standard methods, is provided.

This report is intended to be a resource for chemical as well as oil and gas production professionals.

Scope

This technical report presents basic information on laboratory evaluation of corrosion inhibitors used in the oil and gas industry. It includes 18 inhibitor properties that are evaluated before inhibitors are used in the field and refers to various standards available to evaluate those properties.

Rationale

In this revision, some sentences were modified for better clarity, understanding, technical correctness, and ease of reading. One new property to evaluate corrosion inhibitors – particle size and cleanliness – has been added. New standards developed since the publication of the previous version are included.

> AMPP technical reports are intended to convey technical information on state-of-the-art knowledge regarding corrosion. In many cases, they discuss specific applications of corrosion mitigation technology, whether considered successful or not. Statements used to convey this information are factual and are provided to the reader as input and guidance[8] for consideration when applying this technology in the future. However, these statements are not intended to be recommendations for general application of this technology and must not be construed as such.

Section 1: Introduction

A corrosion inhibitor is a substance that, when added in small concentrations to a corrosive environment, reduces the corrosion rate of a metal in that environment. Commercial inhibitor systems consist of corrosion inhibitor raw materials formulated with surfactants and solvents. Inhibitors are classified in terms of corrosion control mechanism, environment to which they are added, metal to be protected, or inhibitor chemistry. Some of the more commonly encountered classifications include anodic, cathodic, passivating, oxidizing, film-forming, organic, inorganic, environmentally benign, high-temperature and high-pressure stable, vapor phase, and volatile. Corrosion inhibitors are categorized in accordance with their solubility, i.e., water-soluble or oil-soluble.

An effective corrosion mitigation program consists of selecting the proper corrosion inhibitor for a given system and applying it using the most appropriate technique at a right dosage. The treatment technique is selected based on the corrosiveness of the field conditions, amount and composition of produced fluids, production technique, system history, and equipment availability. Depending on the system design, metallurgy, corrosiveness, etc., inhibitors are applied down the well, in pipelines, surface equipment, or in the formation.

Corrosion inhibitors are applied using either continuous injection or periodic batch application techniques based on predicted and sometimes assessed corrosiveness of the system and the adopted corrosion mitigation program. Continuous injection is used in corrosive systems where chemicals are added to the system at a selected rate determined by the chemical program in order to maintain a predetermined concentration of inhibitor in the production fluids. During continuous treatment, a low concentration of corrosion inhibitor is maintained in the system using continuous injection.

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(1) ASTM International (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959, www.astm.org.
(2) International Organization for Standardization (ISO), 1 de la Voie-Creuse, CH-1211, Geneva 20, Switzerland, www.iso.org.