

Protection of Austenitic Stainless Steels and Other Austenitic Alloys from Polythionic Acid Stress Corrosion Cracking During a Shutdown of Refinery Equipment

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ABSTRACT

This standard practice provides mitigation methods to protect austenitic stainless steels and other austenitic alloys from polythionic acid (PTA) stress corrosion cracking (SCC) that can occur during a shutdown of refinery equipment. This standard is directed toward preventing stress corrosion cracking (SCC) caused by polythionic acid (PTA) that can be formed by reaction of oxygen and water with sulfide corrosion products (i.e., metal sulfides) or with other oxidizable sulfur species (e.g., sulfur, hydrogen sulfide [H₂S]). This standard is maintained by Task Group 173.

KEYWORDS

Refineries, austenitic stainless steels, stress corrosion cracking (SCC), polythionic acid.

Foreword

This standard practice provides mitigation methods to protect austenitic stainless steels and other austenitic alloys from polythionic acid (PTA) stress corrosion cracking (SCC) that can occur during a shutdown of refinery equipment. A shutdown includes the actual downtime period and the contiguous periods required to shut down and start up the equipment. This standard is directed toward preventing stress corrosion cracking (SCC) caused by polythionic acid (PTA) that can be formed by reaction of oxygen and water with sulfide corrosion products (i.e., metal sulfides) or with other oxidizing sulfur species (e.g., sulfur, hydrogen sulfide [H₂S]).

Primary mitigation methods to prevent PTA SCC include appropriate selection of materials and fabrication practices, nitrogen purging to exclude oxygen, alkaline washing of equipment surfaces, and use of dry air to prevent liquid water formation. Special considerations for protection of reactors are also discussed.

This standard is intended primarily for petroleum refinery materials and corrosion engineers, as well as inspection, operations, and maintenance personnel. While the main focus of this standard is on equipment in refinery process units such as desulfurizing, hydrocracking, and hydrotreating, in which the incidence of PTA SCC has been comparatively high, it may be applied to equipment in other refinery process units that use austenitic stainless steels and other austenitic alloys, such as crude distillation units, lube distillation units, coking units, and fluid catalytic cracking units (FCCUs), when the user may have a concern for PTA SCC.

This standard was originally prepared in 1970 by NACE Task Group (TG) T-8-19, revised in 1984 and 1993, and reaffirmed in 1997 by Group Committee T-8. It was revised in 2004 and 2012, and reaffirmed in 2017 by TG 173, "Refinery Equipment, Polythionic Acid SCC Prevention: Review of NACE Standard RP0170." TG 173 is administered by Specific Technology Group (STG) 34, "Petroleum Refining and Gas Processing." TG 173 is sponsored by STG 39, "Process Industries—Materials Applications and Experiences," and STG 60, "Corrosion Mechanisms." This standard is issued by NACE International under the auspices of STG 34.

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