



Standard Practice for Determining the Susceptibility of Stainless Steels and Related Nickel-Chromium-Iron Alloys to Stress-Corrosion Cracking in Polythionic Acids¹

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1. Scope

1.1 This practice covers procedures for preparing and conducting the polythionic acid test at room temperature, 22 to 25°C (72 to 77°F), to determine the relative susceptibility of stainless steels or other related materials (nickel-chromium-iron alloys) to intergranular stress corrosion cracking.

1.2 This practice can be used to evaluate stainless steels or other materials in the “as received” condition or after being subjected to high-temperature service, 482 to 815°C (900 to 1500°F), for prolonged periods of time.

1.3 This practice can be applied to wrought products, castings, and weld metal of stainless steels or other related materials to be used in environments containing sulfur or sulfides. Other materials capable of being sensitized can also be tested in accordance with this test.

1.4 This practice may be used with a variety of stress corrosion test specimens, surface finishes, and methods of applying stress.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For more specific precautionary statements, see Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*²

[D1193 Specification for Reagent Water](#)

[G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens](#)

¹ This practice is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.06 on Environmentally Assisted Cracking.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

[G15 Terminology Relating to Corrosion and Corrosion Testing \(Withdrawn 2010\)](#)³

[G30 Practice for Making and Using U-Bend Stress-Corrosion Test Specimens](#)

3. Summary of Practice

3.1 The stressed specimens are placed in the container along with a sensitized and stressed AISI Type 302 (UNS S30200) or Type 304 (UNS S30400) stainless steel control specimen. A sufficient amount of the previously prepared polythionic acid solution is added to the container to immerse the test specimens. A cover is placed on the container and the test is carried out at room temperature.

4. Significance and Use

4.1 This environment provides a way of evaluating the resistance of stainless steels and related alloys to intergranular stress corrosion cracking. Failure is accelerated by the presence of increasing amounts of intergranular precipitate. Results for the polythionic acid test have not been correlated exactly with those of intergranular corrosion tests. Also, this test may not be relevant to stress corrosion cracking in chlorides or caustic environments.

4.2 The polythionic acid environment may produce areas of shallow intergranular attack in addition to the more localized and deeper cracking mode of attack. Examination of failed specimens is necessary to confirm that failure occurred by cracking rather than mechanical failure of reduced sections.

5. Apparatus

5.1 Any suitable glass or other transparent, inert container can be used to contain the acid solution and stressed specimens during the period of test at room temperature, 22 to 25°C (72 to 77°F). The container should be fitted with a removable top to reduce evaporation and to allow access to the stressed specimen (or specimens) for the periodic inspection.

³ The last approved version of this historical standard is referenced on www.astm.org.