NACE International
Standard Test Method

Slow Strain Rate Test Method for Screening Corrosion-Resistant Alloys for Stress Corrosion Cracking in Sour Oilfield Service

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Section 1: General

1.1 This standard establishes a SSR test method for screening CRAs (i.e., stainless steels and nickel-based alloys) for resistance to SCC at elevated temperatures in sour oilfield production environments. The fact that this test method is a screening method implies that further evaluation or additional experience may be required before materials selection decisions can be made.

1.2 This standard specifies reagents, test specimen, test equipment, determination of baseline material properties, environmental and mechanical test conditions, test procedure, and analysis and reporting of test results.

1.3 The test procedure can be summarized as follows: A SSR test specimen is exposed to a continuously increasing uniaxial tensile stress imposed by a slow and constant extension rate in the presence of an acidic aqueous environment containing H_2S, CO_2, and brine at an elevated temperature. The ductility parameters (plastic elongation and reduction in area) obtained from evaluation of the SSR test specimen along with visual observation of its gauge section and fracture surface morphology are used as indicators of the material's resistance to SCC in the test environment. These results are then compared to the results of a similar test performed in an inert environment to quantify the resistance or susceptibility to SCC in the test environment.

1.4 Procedures for SSR testing shall be consistent with those provided in ASTM[(1)] G129.[8] Tests involving high pressure or high temperature, or both, shall be performed using procedures consistent with those provided in ASTM G111.[9] The only deviations from these procedures shall be those specifically stated in this standard.

1.5 Safety Precautions

1.5.1 H_2S is an extremely toxic gas that must be handled with extreme caution. (See Appendix A [nonmandatory] for a discussion of safety considerations and toxicity of this gas.)

1.5.2 Precautions must be taken to protect personnel from the hazards of rapid release of hot gases and fluids and explosion when working with the high-pressure, high-temperature test conditions.

1.6 This standard is not intended to include procedures for cyclic SSR testing. However, such procedures are currently under development and are in use in some laboratories.

Section 2: Reagents

2.1 Reagent Purity

2.1.1 The gases, sodium chloride (NaCl), and solvents shall be reagent or chemically pure grade chemicals. The reasons for this reagent purity are discussed in Appendix B (nonmandatory).

2.1.2 The water shall be distilled or deionized and of quality equal to or greater than ASTM Type IV in accordance with ASTM D1193.[10] Tap water shall not be used.

2.2 Inert gas shall be used for removal of oxygen. Inert gas shall mean high-purity nitrogen, argon, or other suitable nonreactive gas.

Section 3: Test Specimen

3.1 A uniaxial tensile test specimen shall be used for this test because it provides for a simple stress state and a common basis for comparison of test results.

3.2 The SSR test specimen shall be machined from the CRA to be tested in the most appropriate location and orientation relative to the specific evaluation being performed. The material form of the CRA, however, can often place restrictions on the

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