Designation: G 142 – 98 (Reapproved 2004)

Standard Test Method for Determination of Susceptibility of Metals to Embrittlement in Hydrogen Containing Environments at High Pressure, High Temperature, or Both[1]

This standard is issued under the fixed designation G 142; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a procedure for determination of tensile properties of metals in high pressure or high temperature, or both, gaseous hydrogen-containing environments. It includes accommodations for the testing of either smooth or notched specimens.

1.2 This applies to all materials and product forms including, but not restricted to, wrought and cast materials.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 *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.* See 6.1 for additional information.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 1193 Specification for Reagent Water

E 4 Practices for Force Verification of Testing Machines

E 8 Test Methods for Tension Testing of Metallic Materials

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

G 15 Terminology Relating to Corrosion and Corrosion Testing

G 111 Guide for Corrosion Tests in High Temperature or High Pressure Environment, or Both

G 129 Practice for Slow Strain Rate Testing to Evaluate the Susceptibility of Metallic Materials to Environmentally Assisted Cracking

2.2 *Military Standard:*

MIL-P-27201B Propellant, Hydrogen[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *control test*, *n*—a mechanical test conducted in an environment that does not produce embrittlement of a test material.

3.1.2 *hydrogen embrittlement*, *n*—hydrogen induced cracking or severe loss of ductility caused by the presence of hydrogen in the metal.

3.1.3 Other definitions and terminology related to testing can be found in Terminology G 15.

4. Summary of Test Method

4.1 Specimens of selected materials are exposed to a gaseous hydrogen containing environment at high pressure or high temperature, or both, while being pulled to failure in uniaxial tension. The susceptibility to hydrogen embrittlement is evaluated through the determination of standard mechanical properties in tension (that is, yield strength, ultimate tensile strength, notched tensile strength, reduction in area or elongation, or both). Comparison of these mechanical properties determined in a hydrogen-containing environment to those determined in a non-embrittling environment (control test) provides a general index of susceptibility to cracking versus the material's normal mechanical behavior.

5. Significance and Use

5.1 This test method provides a reliable prediction of the resistance or susceptibility, or both, to loss of material strength and ductility as a result of exposure to hydrogen-containing gaseous environments. This test method is applicable over a broad range of pressures, temperatures, and gaseous environments. The results from this test method can be used to evaluate the effects of material composition, processing, and heat treatment as well as the effects of changes in environment composition, temperature, and pressure. These results may or

[1] This test method 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.

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

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