



Standard Test Method for Corrosion Testing of Products of Zirconium, Hafnium, and Their Alloys in Water at 680°F (360°C) or in Steam at 750°F (400°C)¹

This standard is issued under the fixed designation G2/G2M; 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.

^{ε1} NOTE—Editorial corrections were made in Section 14.3.4.1 in October 2013.

1. Scope

1.1 This test method covers (1) the determination of mass gain, and (2) the surface inspection of products of zirconium, hafnium, and their alloys when corrosion tested in water at 680°F [360°C] or in steam at 750°F [400°C].

1.2 This test method is to be utilized in its entirety to the extent specified herein as a product acceptance test.

1.3 This test method may be used on wrought products, castings, powder metallurgy products, and weld metals.

1.4 Unless a single unit is used, for example corrosion mass gain in mg/dm², the values stated in either inch-pound or SI units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore each system must be used independently of the other. SI values cannot be mixed with inch-pound values.

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 specific precautionary statements, see Section 9.

2. Referenced Documents

2.1 *ASTM Standards:*²

D888 Test Methods for Dissolved Oxygen in Water

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

¹ This test method is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.02 on Zirconium and Hafnium.

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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. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *control coupons, n*—zirconium alloy specimens of known performance used to monitor the validity of the test.

3.1.2 *etching, n*—a process for removal of surface metal by action of acids in water.

3.1.3 *Grade A water, n*—purified water having a pH of 5.0 to 8.0 and an electrical resistivity of not less than 1.0 MΩ·cm.

3.1.4 *Grade B water, n*—water prepared with deionized or demineralized water having a minimum electrical resistivity of 0.5 MΩ·cm.

3.1.5 The stated values of pH and electrical resistivity are to be met after the measured values are corrected to 77°F [25°C].

3.1.6 *high mass gain coupons, n*—zirconium alloy specimens that have been specially heat-treated to produce a mass gain higher than the maximum specified as acceptable value used for verifying the severity of the test.

3.1.7 *reagent grade, n*—the grade of chemicals normally used for analytical purposes.

4. Summary of Test Method

4.1 Specimens of zirconium, hafnium, or their alloys are exposed to high-pressure water or steam at elevated temperatures for 72 or 336 h. The corrosion is normally measured by the gain in mass of the specimens and by the appearance of the oxide film on the specimen surfaces. In some instances, such as weld evaluation, mass gain measurements are either impractical to make or not required. When so specified, appearance of the specimen shall be the sole criterion for acceptance.

5. Significance and Use

5.1 This test method is primarily used as an acceptance test for products of zirconium, hafnium, and their alloys. This standard has been widely used in the development of new alloys, heat treating practices, and for evaluation of welding techniques.