



Standard Test Method for Measuring Waste Glass or Glass Ceramic Durability by Vapor Hydration Test¹

This standard is issued under the fixed designation C1663; 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 The vapor hydration test method can be used to study the corrosion of a waste forms such as glasses and glass ceramics² upon exposure to water vapor at elevated temperatures. In addition, the alteration phases that form can be used as indicators of those phases that may form under repository conditions. These tests; which allow altering of glass at high surface area to solution volume ratio; provide useful information regarding the alteration phases that are formed, the disposition of radioactive and hazardous components, and the alteration kinetics under the specific test conditions. This information may be used in performance assessment (McGrail et al, 2002 (**1**)³ for example).

1.2 This test method must be performed in accordance with all quality assurance requirements for acceptance of the data.

1.3 *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.*

2. Referenced Documents

2.1 ASTM Standards:⁴

C162 Terminology of Glass and Glass Products

D1125 Test Methods for Electrical Conductivity and Resistivity of Water

D1193 Specification for Reagent Water

D1293 Test Methods for pH of Water

E177 Practice for Use of the Terms Precision and Bias in

¹ This test method is under the jurisdiction of ASTM Committee **C26** on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee **C26.13** on Spent Fuel and High Level Waste.

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² The precision and bias statements are only valid for glass waste forms at this time. The test may be (and has been) performed on other waste forms; however, the precision of such tests are currently unknown.

³ The boldface numbers in parentheses refer to the list of references at the end of this standard.

⁴ 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.

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E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 Definitions:

3.1.1 *alteration layer*—a layer of alteration products at the surface of specimen. Several distinct layers may form at the surface and within cracks in the glass. Layers may be comprised of discrete crystallites. The thickness of these layers may be used to estimate the amount of glass altered.

3.1.2 *alteration products*—crystalline or amorphous phases formed as a result of glass interaction with an aqueous environment by precipitation from solution or by in situ transformation of the chemically altered solid.

3.1.3 *glass*—an inorganic product of fusion that has cooled to a rigid condition without crystallizing. **C162**

3.1.4 *glass ceramic*—solid material, partly crystalline and partly glassy, formed by the controlled crystallization of a glass. **C162**

3.1.5 *glass transition temperature*—on heating, the temperature at which a glass transforms from an elastic to a viscoelastic material, characterized by the onset of a rapid change in thermal expansivity. **C162**

3.1.6 *immobilized low-activity waste*—vitrified low-activity fraction of waste presently contained in Hanford Site tanks.

3.1.7 *performance assessment*—examines the long-term environmental and human health effects associated with the planned disposal of waste. **Mann et al, 2001 (2)**

3.1.8 *sample*—initial test material with known composition.

3.1.9 *specimen*—specimen is a part of the sample used for testing.

3.1.10 *traceable standard*—a material that supplies a link to known test response in standards international units by a national or international standards body, for example, NIST.

3.2 Abbreviations:

3.2.1 *DIW*—ASTM Type I deionized water

3.2.2 *EDS*—energy dispersive X-ray spectroscopy

3.2.3 *OM*—optical microscopy