



Standard Test Method for Determining Liquidus Temperature of Immobilized Waste Glasses and Simulated Waste Glasses¹

This standard is issued under the fixed designation C1720; 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—Units statement was editorially corrected in April 2015.

1. Scope

1.1 These practices cover procedures for determining the liquidus temperature (T_L) of nuclear waste, mixed nuclear waste, simulated nuclear waste, or hazardous waste glass in the temperature range from 600°C to 1600°C. This method differs from Practice C829 in that it employs additional methods to determine T_L . T_L is useful in waste glass plant operation, glass formulation, and melter design to determine the minimum temperature that must be maintained in a waste glass melt to make sure that crystallization does not occur or is below a particular constraint, for example, 1 volume % crystallinity or $T_{1\%}$. As of now, many institutions studying waste and simulated waste vitrification are not in agreement regarding this constraint (1).

1.2 Three methods are included, differing in (1) the type of equipment available to the analyst (that is, type of furnace and characterization equipment), (2) the quantity of glass available to the analyst, (3) the precision and accuracy desired for the measurement, and (4) candidate glass properties. The glass properties, for example, glass volatility and estimated T_L , will dictate the required method for making the most precise measurement. The three different approaches to measuring T_L described here include the following: (A) *Gradient Temperature Furnace Method (GT)*, (B) *Uniform Temperature Furnace Method (UT)*, and (C) *Crystal Fraction Extrapolation Method (CF)*. This procedure is intended to provide specific work processes, but may be supplemented by test instructions as deemed appropriate by the project manager or principle investigator. The methods defined here are not applicable to glasses that form multiple immiscible liquid phases. Immiscibility may be detected in the initial examination of glass during sample preparation (see 9.3). However, immiscibility may not become apparent until after testing is underway.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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.*

2. Referenced Documents

2.1 ASTM Standards:²

- C162 Terminology of Glass and Glass Products
 - C829 Practices for Measurement of Liquidus Temperature of Glass by the Gradient Furnace Method
 - D1129 Terminology Relating to Water
 - D1193 Specification for Reagent Water
 - E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
 - E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
 - E2282 Guide for Defining the Test Result of a Test Method
- ### 2.2 Other Documents:
- SRM-773 National Institute for Standards and Technology (NIST) Liquidus Temperature Standard
 - SRM-674b NIST X-Ray Powder Diffraction Intensity Set for Quantitative Analysis by X-Ray Diffraction (XRD)
 - SRM-1976a NIST Instrument Response Standard for X-Ray Powder Diffraction
 - Z540.3 American National Standards Institute/National Conference of Standards Laboratories (ANSI/NCSL) Requirements for the Calibration of Measuring and Test Equipment

3. Terminology

3.1 Definitions:

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 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.