Designation: C1843 – 16 (Reapproved 2022)

Standard Test Method for Determining Moisture Content in Uranium-Ore Concentrate[1]

This standard is issued under the fixed designation C1843; 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 is used to determine compliance with Specification C967 for the requirements of moisture in uranium ore concentrates (UOC). A procedure is given to determine the approximate temperature for drying the UOC; normally 110 °C but possibly 165 °C for uranyl peroxides. The dried uranium ore-concentrate resulting from this procedure is then used for performing additional analyses described in Specification C967.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are mathematical equivalents that are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C859 Terminology Relating to Nuclear Materials

C967 Specification for Uranium Ore Concentrate

C1022 Test Methods for Chemical and Atomic Absorption Analysis of Uranium-Ore Concentrate

C1075 Practices for Sampling Uranium-Ore Concentrate

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 Except as otherwise defined herein, definitions of terms are as given in Terminology C859.

4. Summary of Test Method

4.1 The need to establish an appropriate temperature for drying may only occur once for a specific ore concentrate but may be evaluated if the property of the ore is suspected to have changed. An example of a UOC material that may require drying at 165 °C is uranyl peroxide. Other concentrates, such as U_3O_8, UO_2, and UO_3 are generally dried at 110 °C.

4.2 A weighed portion of uranium ore concentrate sample is placed into an oven that is capable of maintaining a temperature of 110 °C or 165 °C. The sample is heated and weighed periodically to a constant weight or an insignificant change in weight.

4.3 A weight change that is insignificant would be defined by the sample size and the required precision.

5. Significance and Use

5.1 The test method within this standard is used to demonstrate uranium ore-concentrate material meets the moisture specification defined in Specification C967 or other applicable requirements.

6. Safety Precautions

6.1 Proper precautions should be taken to prevent inhalation or ingestion of uranium-ore concentrate during ore evaluation, sample preparation, sample analysis, and sample packaging. Precautions used to prevent inhalation or ingestion should include a ventilation system and personal protective equipment. Generally the ventilation system is in the form of laboratory hoods with a dust collection system. Personal protective equipment used should be a respirator designed for particulate matter.

7. Apparatus

7.1 *Drying Oven,* capable of maintaining 110 °C or 165 °C.

7.2 *Desiccator.*

7.3 *Vacuum Pump,* capable of reducing pressure by 34 kPa (5 psi) (25 cm of mercury).

7.4 *Weighing trays.*

[1] This test method is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.05 on Methods of Test.

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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.

7.5 *Pulverizer.*

7.6 *Blender.*

7.7 *Balance,* 3000 g capacity, readable to at least 0.1 g.

7.8 *Sample Jars,* glass with metal lids, able to hold 150 g or as agreed upon.

7.9 *Test Sieve,* 0.177 mm (U.S. Sieve 80 mesh).

7.10 *Test Sieve,* 0.149 mm (U.S. Sieve 100 mesh).

NOTE 1—See Specification E11.

7.11 *Flat Iron,* able to heat sample jar lids to ~82 °C.

8. Reagents

8.1 Anhydrous Calcium Sulfate or equivalent.

9. Sample Size

9.1 The sample size will be determined by the sample collected from Practice C1075. This standard practice should generate a sample of at least 1300 g or 0.01 % of the UOC bulk shipment, depending on which sampling method is used.

NOTE 2—A smaller sample size may be used as long as the laboratory can demonstrate performance characteristics agreed upon by the buyer and seller.

10. UOC Evaluation

10.1 The primary objective is to establish the relationship between the UOC sample and the dry UOC. If Practice C1075 was followed for sampling, then 7 UOC samples of approximately 1300 g each will be provided from the secondary sample drum for the test sample and subsequent testing.

10.2 One of the seven test pans should be placed in the oven and dried at 110 °C ± 2 °C and evaluated for weight loss after 24 h.

10.3 The temperature to be used for drying the UOC to demonstrate compliance with the specification is determined by returning the sample to the oven and reweighing the sample daily for a period of seven days to determine if a stable weight can be obtained at 110 °C ± 2 °C. If a stable weight cannot be obtained, then the sample must be dried at 165 °C ± 2 °C.

10.4 If the test sample gains weight or shows no change in weight, the remaining 6 UOC samples are pulverized, blended, and packaged without additional drying. Complete 11.1 through 11.2 and move to Section 14.

11. Sample Preparation

NOTE 3—If testing for extractable organic is to be done, then an approximate 150-g portion of a blended, but un-ground and undried sample is packaged as described in Section 14.1.

11.1 Pulverize two of the secondary samples collected in accordance with Practice C1075 in a pulverizer.

NOTE 4—Uranyl Peroxides may need to be dried first and then pulverized and blended prior to packaging.

11.2 Transfer the two samples, each containing about 1300 g pulverized material to a blender, and blend for 15 min. Remove a 100-g portion of the blended sample. Pass 100 % of the sub-sample through a screen with apertures of 0.177 mm (U.S. Sieve 80 mesh), and retain no more than 10 % of the sample on a second screen with apertures of 0.149 mm (U.S. Sieve 100 mesh). If material is retained on the 80 mesh screen, or more than 10 % of the sample on the 0.149 mm (U.S. 100 mesh) screen, repeat the pulverization and blending processes until this requirement is achieved.

11.3 Divide the remaining blended material, about 2500 g, into two roughly equal portions and spread evenly in two stainless steel drying pans.

12. Procedure

12.1 Transfer directly two un-pulverized samples of about 1300 g each, which are designated for the moisture determination, and spread in two tared drying pans. Weigh the pans and samples, and then place together with the pulverized and blended samples in adjacent positions in the same oven to minimize temperature and atmosphere differences among the pans. The tare weight of the tray (W_1) and the weight of the tray and sample (W_2) are used in the calculation in Section 13. All weights must be carried out to ±0.1 g.

12.1.1 The remaining two containers collected in accordance with Practice C1075 are retained as extra samples in the event additional UOC material is needed.

12.2 Dry the samples at 110 °C ± 2 °C (230 °F ± 4 °F) or 165 °C ± 2 °C until two successive weights at 24-h intervals until a change of no more than 0.5 g for each tray or by more than 0.1 % moisture as calculated in Section 13, whichever is smaller. The final weight obtained will be used as the weight of the tray and dried sample (W_3) in Section 13. Weighing of the trays of UOC should be completed after the material has cooled to room temperature within a desiccator, containing anhydrous calcium sulfate or equivalent. The moisture content assigned to the lot is the averaged weight percent loss of the two.

NOTE 5—A bias may be determined and applied to the test pans to allow for weighing without cooling.

13. Calculation

13.1 Calculate the percentage of moisture, M, as follows:

$$M = \frac{(W_2 - W_3) \times 100}{(W_2 - W_1)} \quad (1)$$

where:

W_1 = weight of weighing tray, g,
W_2 = weight of weighing tray plus sample, g, and
W_3 = weight of weighing tray plus dried sample, g.

14. Sample Packaging and Vacuum Sealing for Pulverized Samples

14.1 Prior to packaging, heat the jars only (not the lids), to 95 °C ± 2 °C (203 °F).

14.2 As quickly as possible, place six approximately 150 g samples (or other agreed amount) prepared in Section 11 into tared hot glass jars of appropriate capacity.

14.3 Place the metal jar lids on the jars and heat with an electrical flat iron set to control at approximately 82 °C (180 °F) for about 1.5 min to soften the sealing gasket material on the periphery of the lids.