



Standard Test Methods for Chemical Analysis of Glass Sand¹

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1. Scope

1.1 These test methods cover the chemical analysis of glass sands. They are useful for either high-silica sands (99 % + silica (SiO₂)) or for high-alumina sands containing as much as 12 to 13 % alumina (Al₂O₃). Generally nonclassical, the test methods are rapid and accurate. They include the determination of silica and of total R₂O₃ (see 11.2.4), and the separate determination of total iron as iron oxide (Fe₂O₃), titania (TiO₂), chromium oxide (Cr₂O₃), zirconia (ZrO₂), and ignition loss. Included are procedures for the alkaline earths and alkalis. High-alumina sands may contain as much as 5 to 6 % total alkalis and alkaline earths. It is recommended that the alkalis be determined by flame photometry and the alkaline earths by absorption spectrophotometry.

1.2 These test methods, if followed in detail, will provide interlaboratory agreement of results.

NOTE 1—For additional information, see Test Methods C 169 and Practices E 50.

1.3 The test methods appear in the following order:

Procedures for Referee Analysis:	Section
Silica (SiO ₂)—Double Dehydration	10
Total R ₂ O ₃ —Gravimetric	11
Fe ₂ O ₃ , TiO ₂ , ZrO ₂ , Cr ₂ O ₃ , by Photometric Methods and Al ₂ O ₃ by Complexiometric Titration	12-17
Preparation of the Sample for Determination of Iron Oxide, Titania, Alumina, and Zirconia	12
Iron Oxide (as Fe ₂ O ₃) by 1,10-Phenanthroline Method	13
Titania (TiO ₂) by the Tiron Method	14
Alumina (Al ₂ O ₃) by the CDTA Titration Method	15
Zirconia (ZrO ₂) by the Pyrocatechol Violet Method	16
Chromium Oxide (Cr ₂ O ₃) by the 1,5-Diphenylcarbohydrazide Method	17
Procedures for Routine Analysis:	
Silica (SiO ₂)—Single Dehydration	19
Al ₂ O ₃ , CaO, and MgO—Atomic Absorption Spectrophotometry	20-25
Na ₂ O and K ₂ O—Flame Emission Spectrophotometry	26-27
Loss on Ignition (LOI)	28

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 appro-*

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:

C 169 Test Methods for Chemical Analysis of Soda-Lime and Borosilicate Glass²

C 429 Test Method for Sieve Analysis of Raw Materials for Glass Manufacture²

D 1193 Specification for Reagent Water³

E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁴

E 50 Practices for Apparatus, Reagents, and Safety Precautions for Chemical Analysis of Metals⁵

E 60 Practice for Analysis of Metals, Ores, and Related Materials by Molecular Absorption Spectrometry⁵

2.2 Other Documents:

NIST Special Publication 260⁶

3. Significance and Use

3.1 These test methods can be used to ensure that the chemical composition of the glass sand meets the compositional specification required for this raw material.

3.2 These test methods do not preclude the use of other methods that yield results within permissible variations. In any case, the analyst should verify the procedure and technique used by means of a National Institute of Standards and Technology (NIST) standard reference material or other similar material of known composition having a component comparable with that of the material under test. A list of standard reference materials is given in the NIST *Special Publication 260*, current edition.

4. Photometers and Photometric Practice

4.1 Photometers and photometric practice prescribed in these test methods shall conform to Practice E 60.

5. Purity of Reagents

5.1 Reagent grade chemicals shall be used throughout.

² *Annual Book of ASTM Standards*, Vol 15.02.

³ *Annual Book of ASTM Standards*, Vol 11.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ *Annual Book of ASTM Standards*, Vol 03.05.

⁶ Standard samples available from the National Institute of Standards and Technology are listed in U.S. Dept. of Commerce, NIST, *Special Publication 260* (current edition), Washington, DC 20234.

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