



Standard Test Methods for Chemical Analysis of Soda-Lime and Borosilicate Glass¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 These test methods cover the quantitative chemical analysis of soda-lime and borosilicate glass compositions for both referee and routine analysis. This would be for the usual constituents present in glasses of the following types: (1) soda-lime silicate glass, (2) soda-lime fluoride opal glass, and (3) borosilicate glass. The following common oxides, when present in concentrations greater than indicated, are known to interfere with some of the determinations in this method: 2 % barium oxide (BaO), 0.2 % phosphorous pentoxide (P₂O₅), 0.05 % zinc oxide (ZnO), 0.05 % antimony oxide (Sb₂O₃), 0.05 % lead oxide (PbO).

1.2 The analytical procedures, divided into two general groups, those for referee analysis, and those for routine analysis, appear in the following order:

	Sections
Procedures for Referee Analysis:	
Silica	10
BaO, R ₂ O ₂ (Al ₂ O ₃ + P ₂ O ₅), CaO, and MgO	11-15
Fe ₂ O ₃ , TiO ₂ , ZrO ₂ by Photometry and Al ₂ O ₃ by Complexiometric Titration	16-22
Cr ₂ O ₃ by Volumetric and Photometric Methods	23-25
MnO by the Periodate Oxidation Method	26-29
Na ₂ O by the Zinc Uranyl Acetate Method and K ₂ O by the Tetraphenylborate Method	30-33
SO ₃ (Total Sulfur)	34 to 35
As ₂ O ₃ by Volumetric Method	36-40
Procedures for Routine Analysis:	
Silica by the Single Dehydration Method	42-44
Al ₂ O ₃ , CaO, and MgO by Complexiometric Titration, and BaO, Na ₂ O, and K ₂ O by Gravimetric Method	45-51
BaO, Al ₂ O ₃ , CaO, and MgO by Atomic Absorption; and Na ₂ O and K ₂ O by Flame Emission Spectroscopy	52-59
SO ₃ (Total Sulfur)	60
B ₂ O ₃	61 to 62
Fluorine by Pyrohydrolysis Separation and Specific Ion Electrode Measurement	63-66
P ₂ O ₅ by the Molybdo-Vanadate Method	67-70
Colorimetric Determination of Ferrous Iron Using 1,10 Phenanthroline	71-76

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 appro-*

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

2. Referenced Documents

2.1 ASTM Standards:

- C 146 Test Methods for Chemical Analysis of Glass Sand²
- C 225 Test Methods for Resistance of Glass Containers to Chemical Attack²
- D 1193 Specification for Reagent Water³
- E 50 Practices for Apparatus, Reagents, and Safety Precautions for Chemical Analysis of Metals⁴
- E 60 Practice for Photometric and Spectrophotometric Methods for Chemical Analysis of Metals⁴

3. Significance and Use

3.1 These test methods can be used to ensure that the chemical composition of the glass meets the compositional specification required for the finished glass product.

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 employed by means of a National Institute of Standards and Technology (NIST) standard reference material 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*,⁵ current edition.

3.3 Typical examples of products manufactured using soda-lime silicate glass are containers, tableware, and flat glass.

3.4 Typical examples of products manufactured using borosilicate glass are bakeware, labware, and fiberglass.

3.5 Typical examples of products manufactured using fluoride opal glass are containers, tableware, and decorative glassware.

4. Purity of Reagents

4.1 Reagent grade chemicals shall be used throughout. Unless otherwise indicated, it is intended that reagents shall

¹ These test methods are under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and are the direct responsibility of Subcommittee C14.02 on Chemical Analysis.

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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 03.05.

⁵ Available from National Institute of Standards and Technology, Gaithersburg, MD 20899.