METHODS OF SAMPLING AND TESTING
MT 537-16
CHEMICAL ANALYSIS OF GROUND GRANULATED BLAST-FURNACE SLAG
(Montana Method)

1 Scope

1.1 This method describes the procedures to be used for determining chemical analytes of ground granulated blast-furnace slag (GGBFS) as recommended by AASHTO M 302 Slag Cement for Use in Concrete Mortars.

1.1.1 This method includes the procedures for the determination of chloride by Ion Chromatography (IC) and the following reference methods.

1.2 This test method also denotes reference test methods:

1.2.1 Spectroscopic Determination of Sulfur Trioxide – MT 533 Chemical Analysis of Fly Ash and Pozzolans

1.2.2 Sulfide Determination – Reference method in ASTM C114 Section 17.2.

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

ASTM
C114 Standard Test Methods for Chemical Analysis of Hydraulic Cement
D1193 Standard Specification for Reagent Water

AASHTO
M 302 Slag Cement for Use in Concrete Mortars

MT Materials Manual
MT 533 Chemical Analysis of Fly Ash and Pozzolans
MT 607 Procedure for Reducing Field Samples to Testing Size

3 Summary of Test Method

3.1 Chloride ions are extracted from GGBFS with nitric acid. The resulting sample solutions are analyzed on an Ion Chromatograph.

4 Significance and Use

4.1 This procedure is primarily used to provide quality assurance for the GGBFS submittals by suppliers for inclusion on the MDT Qualified Product List as well as provide analytical information for design applications using GGBFS.

5 Apparatus

5.1 *Ion Chromatograph (IC)*

5.2 *Analytical Balance* – A balance with a precision of 0.0001 g should be used.

6 Reagents and Materials

6.1 *Trace metal grade (TMG) Nitric acid (HNO_3)*, concentrated (65-70%)

6.2 *Sodium Hydroxide (NaOH)*, concentration of 0.7 Molar

6.2 *Reagent Water* – Purified water that meets ASTM Type II specifications or better (ASTM D1193)

6.3 *Syringe filters* - particle retention of 0.2 µm

6.4 *Litmus paper* - capable of indicating basicity or acidity

7 Sampling

7.1 GGBFS samples are to be split in accordance with MT 607. A 50 mL sample should be provided to the Chemistry Lab for analysis.

8 Calibration and Standardization

Follow manufacturer's specifications for calibrating and standardizing the IC. Appendix A provides calibrating and standardizing specifications for a Metrohm 883 Basic IC plus for the determination of chloride.

9 Procedure

9.1 Weigh 0.2500 g ± 0.0005 g GGBFS into a 50 mL beaker. Record the mass.

9.2 Gently tap the materials to thinly spread it over the bottom of the beaker.

9.3 Mix 1 mL of reagent water and 200 µL of TMG Nitric Acid.

9.3 Add the acid/water mixture to the sample in a hood and gently break apart clumps using a glass rod.

9.4 Set the mixture on a warm hot plate for five minutes, intermittently grinding any clumps so the slag completely dissolves.

9.5 Remove the sample from the hot plate; let it cool for 10 minutes.

9.6 Add 1 mL of 0.7 M sodium hydroxide to the sample. Check the pH with litmus paper; continue adding sodium hydroxide or nitric acid until the pH is neutral.

9.7 Transfer the sample to a 100 mL volumetric flask and bring to volume with reagent water.

9.8 Using a syringe filter, transfer a sufficient amount of the sample to a vial for the IC.

9.9 Analyze the sample on the IC.

10 Report

10.1 Data Reporting and Retention for GGBFS will be reported as shown below:

Analyte	Report As	Significance
S	SO_3	X.XX
S-	S-	X.XX
Cl-	Cl-	0.0XX

11 Validation

11.1 For validation data and quality control information consult ASTM C114 and ensure all instruments meet its conditions.

APPENDIX A
CHLORIDE DETERMINATION IN GGBFS USING ION CHROMATOGRAPHY

Metrohm 883 Basic IC Plus configuration parameters

Equipment Configuration
Run time: 20 minutes
Injection volume: 20µL
Eluent: 3.2 mM sodium carbonate and 1.0 mM sodium bicarbonate