

DETERMINATION OF INORGANIC CARBON IN CEMENT



Figure 1: CM140 Total Inorganic Carbon (TIC) Analyzer

PRINCIPLES OF OPERATION

Cement samples are treated with acid to release inorganic carbon in the form of CO₂. A carbon dioxide-free carrier gas sweeps the evolved CO₂ from the heated reaction tube through a reflux condenser and a scrubbing solution and into the Carbon Coulometer Cell, which automatically titrates the evolved CO₂.

PROCEDURE

1. Assemble and prepare the components for operation as described in the Instruction Manuals.
2. Determine the blank and run a standard to confirm proper operation of the complete system.
3. Charge the sample flask with a known weight of sample and attach the flask to the apparatus. Sample size ideally should be selected to contain 1000 – 3000 µg carbon.

NOTE: Cement samples may either be weighed directly into the sample flasks or weighed into porcelain, platinum, alumina or similar, clean sample containers and then placed in the flask.

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4. Allow approximately one (1) minute for the system to purge itself of atmospheric CO₂ after attaching the sample flask.
5. Move the whole sample assembly into position over the heater, press “Begin Analysis” on the CM5017 Carbon Coulometer and pump acid into the reaction flask.
6. When all CO₂ is evolved and titrated, the CM5017 automatically detects the endpoint, ends the analysis and prints the result to a USB Flash Drive and/or printer*.

(*) – *Endpoint determination and result calculations are performed automatically based on user selectable settings entered into the CM5017 Carbon Coulometer.*

RESULTS

When samples contain over 1000 µg C, the titration accuracy is better than +/-0.15% relative. Overall accuracy is typically +/-0.3% relative. When sample availability or volume limits the amount of CO₂ evolved to lesser amounts, the accuracy is generally better than 1 µg C.

Analysis times are typically 6 to 8 minutes. Heating and stirring capabilities are included with the CM5330 Acidification Module to assist in the evolution of carbon dioxide and speed up the analysis time.

Final results are shown as concentration (select: carbon, CO₂, or CO₃) or as amount of carbon (select: units only), depending on the user selectable settings, in the Parameters section. Raw data is also saved as µg of carbon and that can be used for further calculations.

A major advantage of the Carbon Coulometer is that the analysis completion can be seen, avoiding low results due to incomplete analysis times or wasted time due to overly long analysis times. Other advantages include the easy addition or modification of scrubbers, the ability to use different acids and the ease of using wetting/emulsifying agents and indicators in the acid.

ADDITIONAL INFORMATION

Additional details about this method are included in the ASTM D-513 Method G, "Carbon Dioxide CO₂ Evolution, Coulometric Titration Method". The method is under jurisdiction of ASTM Committee D19.05 and is available from ASTM.

For information about the instrument's capabilities for specific types of samples, contact the UIC, Inc. or UIC Europe.

Contact us for more information: