

Carbon Analysis (TC/TIC/TOC)

By Automated Combustion and Acidification and Coulometric Detection

Applications include:

Pharmaceuticals, Food, Soils and sediments, Geological materials, Sulfur, Coal



CONFORMS TO ASTM D 513

The CM250 Total Carbon Analyzer is a complete analytical system capable of measuring total carbon, total organic carbon and total inorganic carbon in solid samples. Combining a high-temperature combustion furnace, self-contained acidification module and a highly sensitive CO₂ detector, the CM250 offers the flexibility to analyze most any sample type and concentration with a precision un-matched by other analytical techniques. The CM250 system includes the following components pictured above:

CM5015 CO₂ Coulometer

- No user calibration
- Wide, linear dynamic range
- Readability to 0.01 ug Carbon
- User selectable display units
- 10" LCD Touch Screen
- SD Card data storage
- LIMS Compatible

CM5200 Autosampler Furnace

- Two independent combustion zones programmable up to 1100°C
- 29 position sample carousel
- Post-combustion scrubbers for removal of interfering gases formed during sample combustion

CM5240 Auto-Acidification Module

- 45 position carousel
- Low dead volume reaction chamber
- Self cleaning
- Pre-acidification scrubber for removal of CO₂ from carrier gas
- Post-acidification scrubber for removal of interferences released during sample digestion
- Controlled sample heating

Instrument Capabilities

A major advantage of the CM250 Total Carbon Analyzer is the use of coulometric detection. Employing the principles of Faraday's Law, the CM5015 CO₂ Coulometer automatically measures the absolute mass amount of carbon dioxide resulting from sample combustion or acidification.

No user-calibration is required and linear detection is available from less than 1 ug carbon to over 10,000 ug carbon. Using this 100% efficient coulometric process, relative standard deviations of 0.2% or better are common for standard material. For smaller concentrations, an absolute deviation of approximately 1 ug C is typical.

Oxidation times vary with sample type and temperature although 5 to 15 minute analyses are typical.

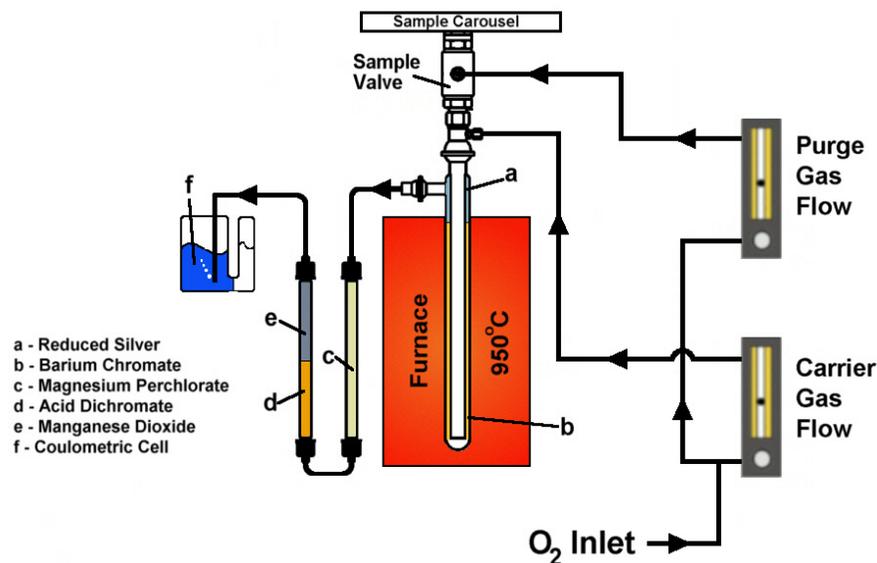
Carbon Analysis Overview

Although our CM5015 CO₂ Coulometer is sensitive to all carbon dioxide entering the coulometric reaction cell, the various carbon forms (TC, TOC and TIC) are distinguished by the manner in which the CO₂ is formed – either combustion or acidification.

To better understand the full capabilities of the CM250 Carbon Analyzer, consider that total carbon (TC) is recognized as the sum of the inorganic (TIC) and organic (TOC) components. Thus, $TC = TIC + TOC$. By either direct measurement, sample pre-treatment, or difference techniques, all of these components can be measured with the CM250.

Specifically, total carbon can always be measured directly by the combustion of a sample while total inorganic carbon can always be measured directly by the acidification of a sample. However, the measurement of total organic carbon for most sample types requires either a pre-treatment step or the separate analyses of TC and TIC in order to obtain TOC by difference ($TOC = TC - TIC$).

Principles of Operation

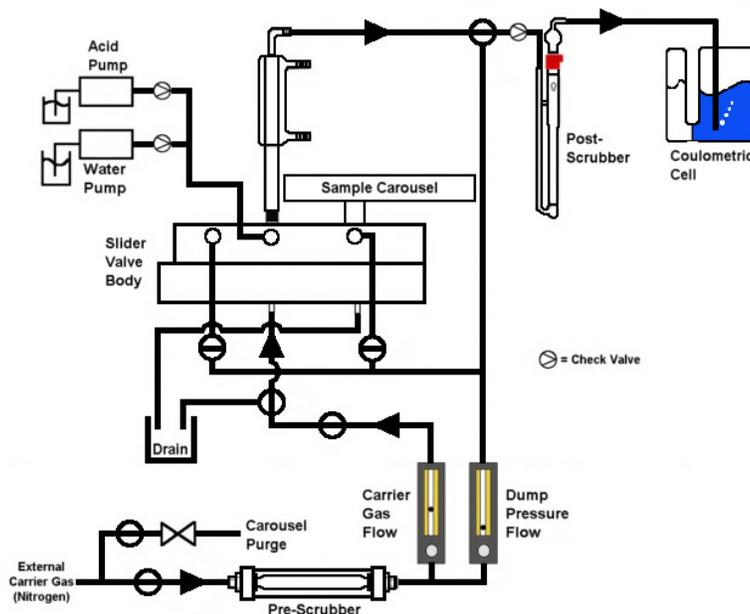


Total Carbon (TC)

The sample is initially weighed into a tin “boat” which is folded and placed into the 29 position sample carousel. Upon operation, the tin boat containing the sample is dropped from the sample carousel into the sample valve. The sample valve is purged and the sample boat is dropped into the combustion tube where it is combusted in a high-temperature oxygen rich atmosphere. In that environment, all carbon within the sample is rapidly oxidized to CO₂. Interfering reaction products (including sulfur oxides, halides, water and nitrous oxides) are removed by the post-combustion scrubbers. The resulting carbon dioxide is then swept into the CM5015 CO₂ Coulometer where it is automatically measured using absolute coulometric titration.

Total Organic Carbon (TOC)

Although the direct TOC analysis of solids is occasionally performed using various sample pre-treatment methods, we generally recommend calculating TOC by difference, where $TOC = TC - TIC$.



Total Inorganic Carbon (TIC)

Samples are initially weighed into disposable Teflon® cups and loaded into a 45 position sample carousel. As the carousel rotates, each sample drops from the carousel into a small chamber where it is purged with a CO₂-free carrier gas to eliminate atmospheric carbon dioxide. Once purged, the sample moves into the acidification chamber where it is oxidized. A second stream of CO₂-free carrier gas transports the products of this reaction through a series of post-scrubbers (to remove potential interferences) and ultimately into the reaction cell within the CM5015 Coulometer. There, the resulting carbon dioxide is automatically measured using absolute coulometric titration.

Data Handling

Names, weights and sizes of up to 50 samples can be entered, to be used by the CM5015 in calculating the final result. Analytical progress is displayed on the 10" LCD touch screen in user-selectable units. Detailed analysis information is automatically saved to an on-board SD card after each sample. Data can also be transmitted through the standard serial and Ethernet ports to be captured on a personal computer or LIMS. In addition, a detailed report can be printed to the optional small format printer while each sample is running.

Ordering Information

CM250 – TC/TOC/TIC Auto-Analyzer

Includes: CM5015 CO₂ Coulometer, CM5200 Autosampler Furnace and CM5240 Auto-Acidification Module with tools and accessories. (P/N CM250-01 110V, 50/60Hz) (P/N CM250-02 220V, 50/60Hz)

Optional Equipment:

Printer – 3" format impact printer. Includes cable, power supply, paper and ribbon. (P/N CM124-078)



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