Inorganic Application Note

Surface Carbon on Steel Sheet and Rod Samples

Introduction

For many applications that require steel sheets or rods the level of contamination, lubrication, or surface composition is a critical quality control parameter. This is especially true in process dependent industries like the automotive and construction industries. For example, the amount of surface carbon contamination can be directly related to the performance of coatings such as primers and paints, or the effectiveness of the lubrication process.

The LECO RC612 is a multiphase carbon and moisture determinator specifically designed to differentiate different forms of carbon by the temperature at which they oxidize. This capability facilitates the determination of the amount of carbon present on the surface of steel sheets or rods, which is relative to the amount of oils or carbonaceous materials. The LECO RC612 provides a robust, fast, and direct determination with little to no sample preparation required.

Accessories

781-335 Quartz Boats or 625-505 Nickel Boats, 780-044 Sample Puller

Sample Dimensions

Maximum Length: 4 inch (10 cm)
Maximum Width: 1 inch (2.5 cm)
Maximum Diameter (rod): 0.9 inch (2.3 cm)

Calibration Samples

LECO 502-029, 502-030, or other suitable reference materials

Note: Surface carbon calibration samples are not readily available. Therefore, LECO 502-029 or 502-030 "synthetic" carbon calibration samples are typically used for calibration. The 502-029 or 502-030 require different furnace parameters than used for surface carbon determination (refer to Furnace Step Method: Calibration Parameters listed below).

Method Parameters

Analysis Parameters

Carrier Gas:	Oxygen
Purge Flow:	3.00 lpm
Analysis Flow:	0.75 lpm
Catalyst Heater Temperature:	750°C

Element Parameters	**Carbon**	**Water**
Analyze	Yes	No
Conversion Factor	1.00	1.00
Significant Digits	5	5
Carbon Range:	Automatic	
Switch level to High Cell:	34000	
Switch level to Low Cell:	28000	
Baseline Time:	2 seconds	
Endline Time:	2 seconds	

RC612

Furnace Step Method: Calibration

Name	*Target*	*Ramp*	*Hold*	*Estimated Time*
Start	500	N/A	0	0
Inorganic	1000	120.00	Carbonate	575-725

Hold Parameters

Carbonate	Carbon	Water
Skip if no Peak (seconds)	0	0
Minimum Analysis Time (seconds)	150	0
Peak Threshold	0	0
Comparator Level	0.30	100.00
Maximum Analysis Time (seconds)	300	60

Furnace Step Method: Sample

Name	*Target*	*Ramp*	*Hold*	*Estimated Time*
Organic	400	N/A	200	200
Amorphous	600	120.00	120	330

Procedure

1. Prepare instrument for operation as outlined in the operator's instruction manual.
2. Determine Calibration Blank.
   a. Select Furnace Step Method: Calibration (parameters noted above).
   b. Enter 1.0000 g mass into Sample Login (F3) using Blank as the sample name.
   c. Place a "clean" 781-335 Quartz Boat (or 625-505 Nickel Boat) on the shelf directly in front of the end of combustion tube and initiate the analysis sequence (F5).

      Note: The combustion tube door should be closed.

   d. When the load sample message appears, select "ok" in the message box, open the door, use the sample puller to slide the boat into the combustion tube until it reaches the boat stop, remove the sample puller, and close the door.
   e. When analysis is complete, remove boat using the sample puller and close the combustion tube door.
   f. Repeat steps 2b through 2e three to five times.
   g. Set the blank following the procedure outlined in the operator's instruction manual.
3. Calibrate.
   a. Weigh ~0.25 gram of the 502-029 Calibration Sample into a "clean" 781-335 Quartz Boat (or 625-505 Nickel Boat) and enter mass and sample identification information into Sample Login (F3).
   b. Place the boat containing the calibration sample on the shelf directly in front of the end of the combustion tube and initiate the analysis sequence (F5).

      Note: The combustion tube door should be closed.

   c. When the load sample message appears, select "ok" in the message box, open the door, use the sample puller to slide the boat into the combustion tube until it reaches the boat stop, remove the sample puller, and close the door.
   d. When analysis is complete, remove boat using the sample puller.
   e. Repeat steps 3a through 3d three to five times for each calibration sample.
   f. Calibrate the instrument using single standard curve following the procedure outlined in the operator's instruction manual.

      Note: Multiple calibration samples and/or fractional weights of the same calibration sample may be used if a multi-point calibration curve is desired. In this case, a linear calibration curve is recommended. Refer to the RC612 instruction manual for details.

4. Determine Sample Blank.
   a. Select Furnace Step Method: Sample (parameters noted above).
   b. Enter 1.0000 g mass into Sample Login (F3) using Blank as the sample name.

      Note: The combustion tube door should be closed.

   c. Initiate the analysis sequence (F5).
   d. When the load sample message appears, select "ok" in the message box. Open the door, insert sample puller into the combustion tube to simulate inserting a sample; remove sample puller and close door.
   e. Repeat steps 2a through 2d three to five times.
   f. Set the blank following the procedure outlined in the operator's instruction manual.
5. Analyze Samples.
   a. Configure the appropriate display fields using the Sample Display Configuration feature (refer to the RC612 instruction manual for details). Select the proper unit (such as mg/ft^2 or mg/dm^2) and sample identification information in Sample Login.
   b. Enter the appropriate surface area or dimensions into the Surface Area field in Sample Login (refer to RC612 instruction manual for details).

      Note: The combustion tube door should be closed.

   c. Place sample on the shelf directly in front of the end of the combustion tube and initiate the analysis sequence (F5).
   d. When the load sample message appears, select "ok" in the message box. Open the door, use sample puller to slide sample into combustion tube until it reaches the boat stop; remove sample puller, and close door.
   e. When analysis is complete, remove sample from the combustion tube.

Typical Results

Sample	Area dm²	mg/dm² Surface C/400°C*	mg/dm² Surface C/600°C**	mg/dm² Total Surface C
Sheet Steel A1	0.51617	0.0318	0.0822	0.114
Sheet Steel A2	0.51617	0.0321	0.0912	0.123
Sheet Steel B1	0.51617	0.0245	0.0610	0.0855
Sheet Steel B2	0.51617	0.0233	0.0595	0.0828

**Organic carbon*
***Amorphous carbon*

Delivering the Right Results

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