

Moisture, Volatile Matter, Ash, and Fixed Carbon Determination in Coal

LECO Corporation; Saint Joseph, Michigan USA

Instrument: TGA701

Sample Preparation

Samples should be prepared in accordance with ASTM Method D2013 or ASTM Practice D346. Coal reference materials such as those offered by LECO and NIST are properly prepared.

Accessories

621-331 Large Ceramic Crucibles, 529-048 Large Ceramic Covers

Calibration Samples

Calibration samples are used to calibrate volatile matter content of samples and are normally not required for moisture or ash determination. Select at least three coal reference materials with known dry basis volatile matter contents. The reference materials must cover the full range of expected volatile matter contents of the coal and samples that will routinely be analyzed. NIST, LECO, or other suitable reference materials may be used.

Sample Mass ~1 gram

Method Reference ASTM D7582

Analysis Time ~5 hours

Method General Parameters

Crucible Type	Ceramic
Crucible Density	3.00
Cover Density	3.00
Sample Type	Coal
Sample Density	1.50

System

Significant Digits	F6
Barometric Pressure	760
Cover Open Half	800
Cover Open Full	450
Furnace Over Temp.	1200
Increment Sample Names	Disable
Crucible Locations	Auto Find
Temperature Check	False
Alarm on Errors	True
Cover Option	Half Open
Carousel Option	Weigh Position
Batch Mode	False
Enable Lid Dispenser	False



Balance

Readability	4
Balance Environment	Stable
Balance Constancy	Absolute Weight (grams)
Minimum Weight	0.8000
Maximum Weight	1.2000
Zero Deviation	0.0005
Retake Initial Weights	False

Method Step Parameters

Parameter	Moisture	Volatile	Ash
Covers Off	No	Yes	No
Start Temp. °C	25	107	600
End Temp. °C	107	950	750
Ramp Rate	6	43	3
Ramp Time (h:m)	00:13	00:19	00:50
Hold Time (h:m)	00:15	00:07	00:00
Total Time (h:m)	00:28	00:26	00:50
Max Time (h:m)	00:00	00:00	00:00
Atmosphere	Nitrogen	Nitrogen	Oxygen
Flow Rate	High	High	Low
Window	3	0	3
Comparator	0.0005*	100.0000	0.0005*
Final Weight	At	At	At
	Constancy	End of Step	Constancy

*Balance constancy set for Absolute Weight (grams)

Method Equation Parameters

Equation Name	Equation Text
Moisture	$(([\text{Initial Mass}] - [\text{Moisture Mass}]) / [\text{Initial Mass}] * 100)$
Volatile	$((([\text{Moisture Mass}] - [\text{Volatile Mass}]) / [\text{Initial Mass}]) * 100)$
Ash	$([\text{Ash Mass}] / [\text{Initial Mass}] * 100)$
Fixed Carbon	$100 - ([\text{Moisture}] + [\text{Volatile}] + [\text{Ash}])$
Volatile Dry	$[\text{Volatile}] * (100 / (100 - [\text{Moisture}]))$
Ash Dry	$[\text{Ash}] * (100 / (100 - [\text{Moisture}]))$
Fixed Carbon Dry	$100 - ([\text{Volatile Dry}] + [\text{Ash Dry}])$

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Organic Application Note

Procedure

1. Create and/or select a method using the parameters described above following the procedure outlined in the TGA701 instruction manual.
2. Calibrate for volatile matter by using a minimum of three coal reference materials by following the procedure outlined in the TGA701 instruction manual.
3. After calibration for volatile matter is complete, analyze unknown samples following the procedure outlined in the TGA701 instruction manual.

Typical Results (Dry Basis)

Sample	Mass g	% Moisture	% Volatile	% Ash	% Fixed C
LECO 502-680	1.0051	0.92	17.08	10.93	71.99
Coal	1.1049	0.93	17.09	10.95	71.96
@ 17.1% Dry Vol,	1.0027	0.92	17.13	10.96	71.92
11.0% Dry Ash	1.0589	0.91	17.09	10.95	71.96
	1.0213	0.92	17.12	10.93	71.96
Avg	1.0386	0.9212	17.10	10.94	71.96
Std Dev	0.04	0.00590	0.018	0.013	0.026
RSD	4.175	0.641	0.104	0.122	0.036

LECO 502-681	1.0535	1.25	32.47	8.93	58.60
Coal	0.8800	1.25	32.62	8.98	58.40
@ 32.6% Dry Vol,	0.8630	1.27	32.43	9.01	58.56
9.09% Dry Ash	0.8531	1.26	32.81	8.99	58.20
Avg	0.9124	1.2550	32.59	8.97	58.44
Std Dev	0.09	0.00970	0.173	0.035	0.182
RSD	10.38	0.773	0.532	0.393	0.312

LECO 502-682	1.0691	8.93	41.20	5.79	53.01
Coal	0.9805	8.92	41.16	5.80	53.04
@ 41.3% Dry Vol,	0.9779	8.94	41.41	5.76	52.83
5.81% Dry Ash	1.0541	8.92	41.54	5.79	52.67
	1.0387	8.93	41.23	5.81	52.96
Avg	1.0241	8.9266	41.31	5.79	52.90
Std Dev	0.04	0.00930	0.159	0.018	0.150
RSD	4.135	0.104	0.386	0.311	0.284

