LOI in Combustion Residues

LECO Corporation; Saint Joseph, Michigan USA

Instrument: TGA701

Introduction

Thermogravimetric analysis (TGA) is an analytical technique in which changes in physical and chemical properties of materials are measured as a function of temperature and/or time. TGA is commonly used to determine selected characteristics of materials that exhibit either mass loss, or gain, due to decomposition, oxidation, or loss of volatile materials such as moisture. Macro TGA systems using gram-size samples allow more accurate mass measurements for characterization of heterogeneous materials.

Loss on Ignition (LOI) refers to the mass loss of a combustion residue when it is heated in an air or oxygen atmosphere to a high temperature. In the cement industry the term LOI refers to a mass loss in a sample heated to 950°C. LOI values in combustion residue values are used by industries that utilize combustion residues in various processes and products, such as the production of cement, providing a quality parameter estimating the amount of unburned carbon and other possible constituents in the combustion residues.

Sample Preparation

Sample should be a fine powder (-60 mesh)

Accessories

621-331 Ceramic Crucibles (Large)

Sample Mass

~1.0 g

Method Reference

ASTM D7348

Analysis Time

~3 hours

Method General Parameters

Crucible Type	Ceramic
Crucible Density	3.00
Cover Density	3.00
Sample Type	Fly ash or combustion residue
Sample Density	1.50
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
Readability	4
Balance Environment	Stable
Balance Constancy	Absolute Weight (grams)
Minimum Weight	0.8 g
Maximum Weight	1.2 g
Zero Deviation	0.0005
Retake Initial Weights	False

Method Step Parameters

Parameter	*Moisture*	*Step-1*	*LOI*
Covers	No	No	No
Start Temp. °C	25	110	500
End Temp. °C	110	500	950
Ramp Rate	6	6	8
Ramp Time (h:m)	0:14	1:05	0:56
Hold Time (h:m)	0:05	0:05	0:00
Total Time (h:m)	0:19	1:10	0:56
Max Time (h:m)	0:00	0:00	0:00
Atmosphere	Nitrogen	Oxygen	Oxygen
Flow Rate	High	High	High
Window	3	0	3
Comparator	0.0003 g	100.0000 g	0.0003 g
Final Weight	At Constancy	At End of Step	At Constancy

Method Equation Parameters

Moisture

(([Initial Mass]-[Moisture Mass])/[Initial Mass])*100

Step-1

(([Moisture Mass]-[Step-1 Mass])/[Initial Mass])*100

LOI

(([Initial Mass]-[LOI Mass])/[Initial Mass])*100

LOI Dry

(([Moisture Mass]-[LOI Mass])/[Initial Mass])*100

Procedure

1. Create and/or select a method using the parameters described above following the procedure in the TGA701 Instruction Manual.
2. Login and load samples following the procedure outlined in the TGA701 Instruction Manual.

Organic Application Note

Delivering the Right Results

Typical Results

Sample	*Mass (g)*	*% Moisture*	*% LOI*
LECO 502-813	1.1226	0.10	1.48
Fly Ash	1.1112	0.09	1.47
	1.1375	0.08	1.48
	$\bar{\chi}$=	***0.09***	***1.48***
	***s*=**	***0.01***	***0.01***
Coal Fly Ash #1	1.0915	0.04	0.53
	1.0901	0.10	0.61
	1.0901	0.07	0.54
	$\bar{\chi}$=	***0.07***	***0.56***
	***s*=**	***0.03***	***0.04***
Coal Fly Ash #2	1.0949	0.02	0.38
	1.0442	0.02	0.33
	1.0604	0.07	0.38
	$\bar{\chi}$=	***0.04***	***0.36***
	***s*=**	***0.03***	***0.03***
Portland Cement	1.0394	0.41	1.75
	1.0931	0.48	1.76
	1.1096	0.48	1.77
	$\bar{\chi}$=	***0.46***	***1.76***
	***s*=**	***0.04***	***0.01***

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