Sulfur in Ore Concentrate

LECO Corporation; Saint Joseph, Michigan USA

Instrument: CS744, S744

Introduction

Since most ores only contain a small amount of metal relative to the ore, one of the first steps of metal extraction from ore minerals is the separation of target minerals from the unwanted rock and gangue or waste minerals. The byproduct of this process is called the ore concentrate, typically a mixture of target metal sulfide ores, other sulfide minerals, and some gangue minerals. The sulfur level of the concentrate can then be used as a quality control measure to determine the efficiency of the concentration process and provide an estimate of the metal-in-concentrate. With its wide sulfur detection range and easy-to-use touch-screen interface, the CS/S744 sulfur by combustion analyzer makes the perfect addition to any mining operations laboratory. The following application note outlines the setting and steps required to determine the sulfur level in ore concentrates with the CS/S744.

Sample Preparation

Samples should be crushed to a uniform powder prior to analysis.

Accessories

528-018 or 528-018HP Crucible; LECOCEL® II (502-173) or (501-008); Iron Chip Accelerator (502-231) or (501-077); Metal Scoop (773-579); Tongs (761-929).

For optional sulfur precision, ceramic crucibles should be pre- baked in a muffle oven at ≥ 1000°C for a minimum of 1 hour or tube furnace (LECO TF1/TF-10) at ≥ 1250°C for a minimum of 15 minutes. The crucibles are removed from the tube furnace/muffle oven, allowed to cool, and then are transferred to a desiccator for storage. Baked crucibles must be handled with clean tongs only to avoid contamination.

Calibration

LECO 502-085 Zinc Sulfide Reference Material. Other suitable ore concentrate Reference Materials may also be used.

Method Parameters

General Parameters

Purge Time	10 s
Delay Time	20 s
Sample Cool Time	0 s
Furnace Power	100%

Element Parameters	*Sulfur*
Integration Delay	0 s
Starting Baseline	2 s
Use Comparator	No
Integration Time	55 s
Use Endline	Yes
Ending Baseline	2 s

Procedure for Sulfur Method

1. Prepare the instrument as outlined in the operator's instruction manual.
2. Determine the instrument blank.
   a. Login a minimum of three Blank reps.
   b. Add ~1 g of LECOCEL II and ~1 g Iron Chip accelerator to a preheated 528-018 or 528-018HP Crucible.
   c. Place the crucible on the furnace pedestal (or appropriate autoloader position if applicable) and initiate analysis.
   d. Repeat steps 2b through 2c a minimum of three times.
   e. Set the blank by following the procedure outlined in the operator's instruction manual.
3. Calibrate/Drift Correct.
   a. Login a minimum of three Reference Material reps.
   b. Weigh ~0.05 g of 502-085 Zinc Sulfide Reference Material or other suitable calibration/drift material into the crucible and enter the mass and identification of the Reference Material.

   Note: Alternate calibration: Use ~0.02 through ~0.05 g for multi mass linear calibration. (Three Reference Material reps @ each mass.)

   c. Add ~1 g of LECOCEL II and ~1 g Iron Chip accelerator on top of the Reference Material.
   d. Place the crucible on the furnace pedestal (or appropriate autoloader position if applicable) and initiate analysis.
   e. Repeat steps 3b through 3d a minimum of three times for each calibration/drift Reference Material intended for calibration/drift.
   f. Calibrate/drift correct by following the procedure outlined in the operator's instruction manual.
4. Sample Analysis.
   a. Login a Sample with the appropriate number of reps.
   b. Weigh ~0.020 to 0.10 g of Ore concentrate sample into the crucible and enter the mass and identification.

   Note: Maximum instrument range is 17.5 mg Sulfur.

   c. Add ~1 g of LECOCEL II and ~1 g Iron Chip accelerator on top of the sample.
   d. Place the crucible on the furnace pedestal (or appropriate autoloader position if applicable), and initiate analysis.

Inorganic Application Note

Delivering the Right Results

Typical Results

Sample	*Mass (g)*	*Sulfur %*
Copper Concentrate	0.0595	24.36
	0.0591	24.22
	0.0603	24.15
	0.0569	24.52
	0.0595	24.36
	0.0598	24.07
	0.0602	23.99
	0.0598	24.28
	0.0600	24.32
	0.0593	24.31
	$\overline{\chi}$ =	***24.26***
	s =	***0.16***
Copper Concentrate	0.0596	28.88
	0.0601	28.74
	0.0600	28.74
	0.0597	29.37
	0.0593	29.33
	0.0606	28.79
	0.0602	28.64
	0.0602	29.08
	0.0606	29.13
	0.0605	28.81
	$\overline{\chi}$ =	***28.95***
	s =	***0.26***
Lead Concentrate	0.1038	14.33
	0.1018	14.63
	0.1000	14.42
	0.1021	14.60
	0.1000	14.43
	0.1012	14.51
	0.1005	14.44
	0.1038	14.09
	0.1026	14.48
	0.1014	14.51
	$\overline{\chi}$ =	***14.44***
	s =	***0.15***

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