LAARMANN®

Innovators in Solids

Application analysis of Ferrochrome

Ferrochrome is an alloy of chromium and iron containing between 50% and 70% chromium. The ferrochrome is produced by electric arc melting of chromite and chromium ore.

Laarmann Group B.V.
Op het Schoor 6
6041 AV Roermond
Netherlands

info@laarmann.eu
www.laarmann.eu
webshop.laarmann.eu
+31 6 23 40 00 33

LMFC250 AND THE CHROMENORM

Sampling according to the ISO 4552-1 Ferroalloys norm

The methods of sampling and sample preparation specified in this part of ISO 4552 allow the determination of the chemical composition of a consignment at the 95 % confidence level with the overall precision shown in **table 2**, depending on the mass of the consignment sampled.

The methods for sample preparation specified in this part of ISO 4552 give the precision of sample preparation, at the 95% confidence level, shown in **tabel 1**.

Sample division

The methods of sample preparation shall comply with the requirements of ISO 3713. A sample shall be crushed to particles which will completely pass through a sieve with a mesh size of 10 mm x 10 mm. Then a gross sample or a sub-sample shall be divided in accordance with **table 2**, and increments, if necessary, shall be divided in accordance with the division rules for the increment division method specified in ISO 3713.

Crushing and mixing

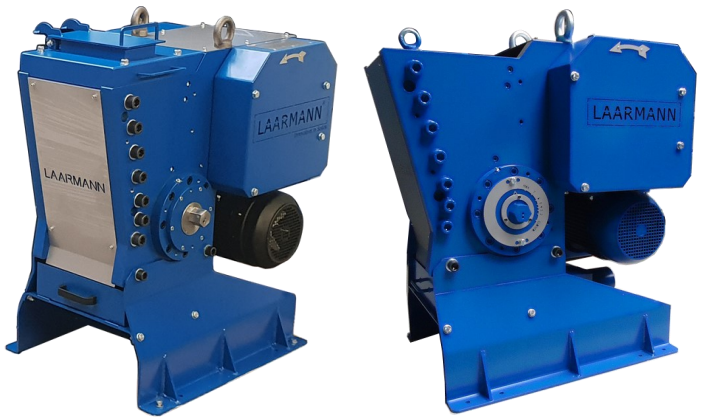
The methods for crushing and mixing shall comply with the requirements of ISO 3713.

Test sample

The mass of a test sample for chemical analysis shall be not less than 50 g. The top size of a test sample shall be not greater than 160 µm. The top size of a non crushable ferro - chrome sample taken as drillings shall not exceed 1,6 mm. The number of test samples, their packing and labelling shall comply with the requirements of ISO 3713.

Industry

The steel production is the largest consumer of Ferrochrome, especially the production of stainless steel with a chromium content of between 10 and 20%. Companies like Outokumpu, Tata Steel, Thyssen, Arcelor Mittal need to add to liquid steel, Ferro Chrome to reach a certain amount to sell it as Stainless Steel.



LMFC250 is the most ideal machine to crush ferrochrome within the ChromeNorm

Technical specifications LMFC250	
Jaw Inlet	130mm x 250mm
Adjusting range of Jaw outlet	0 - 5mm
Weight	880 kg
Electrical requirements (3 phase)	7,5 KW, 3-phase 50Hz
End-fineness (depending on material characteristics)	90% smaller than 2 mm
Max	< 110mm
Throughput (depending on material characteristics)	180 kg/h

Table 1 - Precision of sample preparation

Ferroalloy	Precision of sample preparation, ± Po. % lm / ml		
	Cr	Si	Mn
Ferrochromium			
-crushable	0,4		
-non-crushable	0,6		
Ferrosilicochromium	0,4	0,4	
Ferrosilicon		0,6	
Ferrosilicomanganese		0,3	0,3
Ferromanganese			0,3

Source: international chomenorm ISO 4552-1

Table 2 - Rules for division of **a groA** sample or a sub-sample

Top elze of divided sample mm	Minimum man of divided sample kg
10,0	15,0
5,0	3,0
2,8	1,5
1,0	0,400
0,250	0,200

Source: international chomenorm ISO 4552-1

LMFC250 AND THE CHROMENORM

Process

Ferrochrome with chrome content below 56% is known as ‘charge chrome’ and produced from a chrome containing ore with a lower chrome content.

Alternatively, High Carbon Ferro-Chrome produced from higher grade ore, is more commonly used in specialist applications such as engineering steels where a high Cr to Fe ratio and minimum levels of other elements such as sulfur, phosphorus and titanium are important.

Low-carbon Ferro-Chrome is used during steel production to correct chrome percentages, without causing undesirable variations in the carbon or trace element percentages. It is also a low cost alternative to metallic chrome for uses in super alloys and other special melting applications

Process description

Example: Toyota buys 2.000 tons of Stainless Steel and sends out a tender to the above mentioned companies and they will make a price. The problem for them is that SS304 is a stock exchange item and therefore complicated to make good margin on it. When one of them gets the order, they need lots of raw material to produce the steel.

Crushing

In order to reach a certain minimum quantity of Chrome in their steel the steel producer need to check the quality of their Ferro Chrome. Now they take around 30 kilogram of sample (how they do this it is a different project(!)), but anyway they have 30 kg of FeCr. Normally they give out to a commercial lab the crushing activity, which will cost money.

Finally the crushing company will send only around 400 gram (again the question how they take the 400 gram!) to a another commercial lab to make a pellet of 12 gram for XRay analyses. This company informs the crushing company about the FeCr content and they will collect the rest (30 kg-/- 400gram) in a big bag containing the material with the same value of FeCr.

Test results of the LMFC250 Fine Crusher

Crushing installation with LMFC250 fine crusher and rotary sample divider

FERROCHROME APPLICATIONS

The input feed size of the ferro alloys is up to 110mm. The LMFC250 is a high performance crusher The sample is crushed in one operation from 110mm down 1-2mm.

LMFC250 Fine Crusher with frame

Application

Market segment:	Mineralogy / Metallurgy
Material:	Ferrochromium
Feed size:	0-70 mm
Feed quantity:	300 g
Material specification(s):	tough
Customer requirment(s):	< 2 mm
Subsequent analysis:	MW Micro Wave Digestion

Solution

Selected instrument(s):	LMFC250 Fine Crusher
Configuration(s):	Breaking jaws of stainless steel
Working settings:	Gap width: touching
Time:	1 min.
Achieved result(s):	predominantly < 5 mm
Remark(s):	-
Recommendation(s):	The LMFC250 Fine Crusher is suitable to grind the sample material under the above mentioned conditions.

Application

Market segment:	Mineralogy / Metallurgy
Material:	Ferro Alloys: FeCr / FeCr / FeV / FeMo
Feed size:	60-80 mm
Feed quantity:	3000 g (per sample)
Material specification(s):	hard brittle, tough
Customer requirement(s):	5 mm; pre-crushing for following preparation for the LM2000 Pulverising Ring mill
Subsequent analysis:	X-ray Fluorescence Analysis

Solution

Selected instrument(s):	LMFC250 Fine Crusher
Configuration(s):	LMFC250 Fine Crusher with breaking jaws of precision-cast manganese steel
Working settings:	Distance of breaking jaws: 5 and 2 mm (2 work steps)
Time:	2 min. (only hard brittle products)
Achieved result(s):	FeCr , FeCr and FeMo: predominantly 5 mm
Remark(s):	Due to their tough material properties the samples FeV and FeW are difficult to be crushed or rather not crushable (depending on the material composition).
Recommendation:	A pre-crushing the LMFC250 Fine Crusher is only possible with hard brittle ferro alloys according to the above mentioned conditions.

FERROCHROME INSTALLATION

Ferroalloy Crusher for Sample Preparation

Saving money with your own sample preparation.

LAARMANN Group BV has developed an efficient system for sample preparation in the steel industry. With this system less material is needed to be send out for external analysis. This provides a mayor saving in material costs. Additionally the system simplifies the preparation process in a way that the amount of samples can be increased resulting in a quality improved of the production process.

The determination of the quality from the purchased or produced goods is depending on the way a representative sample is taken and the preparation of this sample. In-line sampling is crucial to monitor and control the production process. Incorrect taken samples or samples processed in an incorrect way will lead to false analyses, resulting in goods being approved (false positive) or declined (false negative) wrongly. In the last 12 years LAARMANN Group BV has specialised itself in advising, designing and building solutions for representative sampling and processing of bulk materials.

Implementation

LAARMANN Group B.V. strongly encourages (bulk processing) companies to implement their own sampling process instead of outsourcing it. Outsourcing this process creates many expenses, just think about the amounts of product that are lost during the process.
To ensure that an external company has a representative amount of material the companies need to send dozens of kilograms, where for the actual chemical analysis they require only a few hundred grams. Apart from the questions whether the external company produces a representative subsample, the companies never see the remaining material (the reject) again. The question is what happens with this, often, costly material.
In this way, especially when there are big quantities of precious material, it is most preferred that companies process their own samples. With a good sample preparation process, the amount of sample that needs to be send for analysis can be reduced from dozens of kilograms to a few hundred grams. Processing the samples in house will make it possible to take multiple samples to determine the quality of the bulk even better. Companies who successful implement this system not only reduce their material cost but also their transport cost.

FERROCHROME INSTALLATION

Steel industry

LAARMANN Group B.V. developed an efficient and reliable system for sample processing of raw materials. In this specific case we look at the production of Stainless steel. To create stainless steel you add precise amounts of Chrome, Nickel, Titanium and Molybdenum to Iron. These materials, who represent high value, are bought as Ferroalloys.

Correct determination of the metal content within these alloys is crucial when producing stainless steel. A shortage of certain elements will lead to an inferior quality of stainless steel, while an excess will only increase the costs of the production.

Size reduction

To determine the qualities of the Ferroalloys the pieces of alloy (60-70 mm) are sampled and then reduced. The steel company used to reduce the 25 kg of materials using a jaw crusher (reduction down to 10 mm). After the primary crushing the operator needed to grab the material from underneath the machine and put it in a rolls crusher. Here the product was further reduced to grit (< 2mm). The sample was send over to an external laboratory for analyses.

Push off a button

The installation of LAARMANN Group BV has simplified the size reduction process for this steel company to a mere push of a button. Now since there is no more need for the operator to lift any heavy materials or perform multiple actions the process is more efficient, resulting in more samples and an overall higher quality.

The operator puts 25 kilograms of material in the inlet funnel and starts the process at the central control box. A vibratory feeder underneath the inlet funnel evenly feeds the bucket elevator. The bucket elevator lifts the material and feeds the jaw crusher (type LMFC250) which reduces the material to < 2mm.

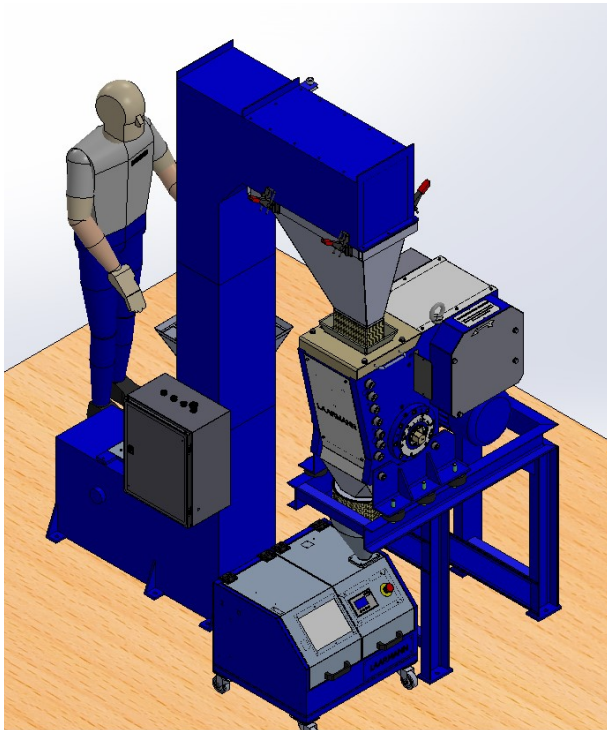
The grit material goes, using a flexible connection, to a rotary sample divider which divides the sample in ten equal parts of 2,5 kilograms (sub samples).

The alloys have a density between 3 and 8 kg/liter, giving a partial sample volume of 500 to 800 ml.

This sample will be pulverised in a ring mill (type LM2000) to reach the desired end finesses of 125 micron.

The external lab needs 12 to 15 grams of this product to make it into a tablet that can be analysed with an XRF-machine (X-ray fluorescence).

FERROCHROME INSTALLATION



From bulk to sample

LAARMANN Group BV in Roermond realises unique total solutions for sampling and sample preparation. Instead of limiting themselves to providing laboratory equipment, the company offers a complete assessment of the sampling processes for a client. Specialist investigated and take under review the current technics and procedures. This way they map the entire process of the sample in one day, starting with receiving the material in bulk which arrives by ship, train or truck up to final analyse of the sample. Only based on the right insight it is possible to advice companies on how to prepare and take a representative sample.

Cleaning

The funnel above the LMFC250 jaw crusher can be moved aside so that the installation can handle smaller quantities of material without contamination of the bucket elevator. Sliding the funnel aside will make the crusher easy accessible for cleaning. The bucket elevator has multiple hatches which can be opened for cleaning the buckets. However cleaning the bucket elevator will not be needed on a regular bases, due to the fact that the material entering the bucket elevator is quit big, there will not be a lot of dust.
The integrated rotary sample divider is mobile so it also can be used as a standalone machine in the lab. Thanks to the compact design of this installation the space of the laboratory, which often don't have much space to begin with, is used optimally.

Advantages

The advantages of the LAARMANN-installation for this steel company can be summarized as:

- The amount of material that needs to be send to an external laboratory is reduced from 25 kg to a mere 400 gram. In this way the loss of costly material is very limited.
- The working conditions of the operator are considerably improved. His work load has, thanks to the sample installation, been reduced and he is now wider available for different tasks.
- The efficiency of the installation allows more samples to be taken and therefore improving the overall quality and representability of the process.
- A more accurate analysis of the purchased good triggers the suppliers to deliver the high quality raw material. Inferior delivered quality will be spotted in an early stage.
- The installation can operate in an oxygen free environment to eliminate the chances of explosion which is common for some Ferroalloys.