

INTERNATIONAL STANDARD

**ISO
6154**

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Chromium ores — Preparation of samples

Minerais de chrome — Preparation des échantillons



Foreword

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International Standard ISO 6154 was prepared by Technical Committee ISO/TC 65, *Manganese and chromium ores*.

Annex A forms an integral part of this International Standard.

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International Organization for Standardization

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Chromium ores — Preparation of samples

1 Scope

This International Standard specifies the methods of preparing samples of chromium ores for determining the chemical composition and moisture content of a consignment. The methods are applicable to all chromium ores, whether natural or processed.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 565 : 1983, *Test sieves — Woven metal wire cloth, perforated plate and electroformed sheet — Nominal sizes of openings*.

ISO 6153 : 1989, *Chromium ores — Increment sampling*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 lot : A definite quantity of an ore, processed or produced under conditions which are presumed uniform.

3.2 consignment : A quantity of an ore delivered at one time. The consignment may consist of one or more lots or parts of lots.

3.3 increment :

- (1) A quantity of an ore taken by a sampling device at one time from a consignment.
- (2) A quantity taken by the increment division method.

3.4 sub-sample :

- (1) A quantity of an ore consisting of two or more increments taken from a consignment.
- (2) An aggregation of two or more increments each of which has been optionally crushed and/or optionally divided as necessary.

3.5 gross sample :

- (1) The quantity of an ore consisting of all the increments taken from a consignment.
- (2) An aggregation of all the increments or all the sub-samples each of which has been optionally crushed and/or optionally divided as necessary.

3.6 divided sample : A sample obtained by a method of division.

3.7 test sample : Any sample for the determination of moisture content or chemical composition, which is prepared from each increment, each sub-sample, or from the gross sample in accordance with the specified method for that type of sample.

A representative part of a test sample which is actually subjected to the method mentioned above is designated "test portion". If the entire quantity of a test sample is subjected to the test, the test sample may also be called "test portion".

3.8 moisture sample : The sample taken for the determination of moisture content of the consignment.

3.9 sample for chemical analysis : The sample taken for the determination of chemical composition of the consignment.

3.10 whole-through sieve size : Particle size expressed by the smallest sieve aperture size through which all of a sample passes.

3.11 sample preparation : The process of preparing the sample for the determination of quality characteristics. It covers sample division, crushing, mixing and sometimes pre-drying and may be performed at several stages.

3.12 sample division : The process in sample preparation whereby the mass of a sample is reduced by partition or extraction without crushing.

3.13 constant-mass division : A type of division for obtaining divided samples having almost uniform mass regardless of the variation in mass of samples to be divided.

NOTE — Almost uniform mass means that the variation in mass shall be less than 20 % in terms of the coefficient of variation (CV).

3.14 fixed-rated division : A type of division for obtaining divided samples having such masses as to be proportional to the varied masses of samples to be divided.

3.15 split-use of sample : The sample is split into two or more parts, which are used individually for the determination of their two or more quality characteristics.

3.16 multiple-use of sample : The sample in its entirety is used for the determination of one quality characteristic, then the same sample in its entirety or part is used for the determination of other quality characteristics.

4 General procedures for sample preparation

The increments taken in accordance with ISO 6153 for the required determinations shall be separated into test samples according to the following general procedures :

- Determine whether the test sample is to be prepared from each increment, from each sub-sample or from the gross sample according to the requirements for the determination of quality characteristics.
- Determine whether the sample is in split-use or in multiple-use.
- Select the method and type of sample division at each stage.
- Establish the flow of sample preparation including the processes of division, crushing, mixing and pre-drying (if necessary).

Prepare the test sample according to the procedures mentioned above.

5 Principles of sample preparation

5.1 Precision of sample preparation and overall precision

The precision of sample preparation (β_D) shall be within $\pm 0,5$ % in chromium or moisture content with a 95 % probability. However, if sample preparation is carried out first on individual increments or sub-samples at an appropriate stage of the sample preparation and then those divided increments or sub-samples are combined into the gross sample, the precision of sample preparation will be further improved (see 5.1.2 and 5.1.3).

The overall precision in terms of standard deviation (σ_{SDM}) for the cases where division and measurement are carried out on the gross sample, on each of the sub-samples or on each of the increments may be expressed as given in 5.1.1 to 5.1.3.

5.1.1 When the gross sample is composed for one consignment and l determinations (chemical analyses) are carried out on the gross sample, the overall precision is given by the equation

$$\sigma_{SDM}^2 = \sigma_S^2 + \sigma_D^2 + \frac{\sigma_M^2}{l}$$

where

σ_S is the precision of sampling in terms of standard deviation;

σ_D is the precision of sample preparation in terms of standard deviation comprising the processes from the gross sample to the test sample;

σ_M is the precision of measurement in terms of standard deviation.

5.1.2 When k sub-samples, whereby each sub-sample consists of an equal number of increments, are compared and l determinations are carried out on each sub-sample, the overall precision is given by the equation

$$\sigma_{SDM}^2 = \sigma_S^2 + \frac{\sigma_D^2 + \sigma_M^2/l}{k}$$

where

σ_D is the precision of sample preparation in terms of standard deviation comprising the processes from the sub-sample to the test sample.

5.1.3 When l determinations are carried out on each increment, the overall precision is given by the equation

$$\sigma_{SDM}^2 = \sigma_S^2 + \frac{\sigma_D^2 + \sigma_M^2/l}{n}$$

where

σ_D is the precision of sample preparation in terms of standard deviation covering the processes from the increment to the test sample;

n is the number of increments.

5.2 Composition of samples

When samples are to be composed of the increments, the following shall be taken into consideration :

- the quality characteristics to be determined;
- the overall precision to be attained;
- the coefficient of variation (CV) in the mass of the increments taken by mass-basis sampling.

Combining of increments taken on time-basis sampling and mass-basis sampling shall incorporate the procedures specified in clause 7.

5.3 Division rules

In order to obtain the specified precision of sample preparation the following aspects of division shall be taken into consideration :

- the minimum mass of the sample after division, specified for each quality characteristic to be determined;
- the method and type of division to be adopted;
- the whole-through sieve size of the sample to be divided.

5.4 Methods and types of division

One or more of the following methods of sample division shall be conducted individually or jointly :

- manual increment division method;
- manual riffle division method;
- coning and quartering method;
- mechanical division method.

This International Standard shall be applied to increments or sub-samples on the basis of taking increments and division type as shown in table 1.

5.5 Split-use and multiple-use of sample

When a sample taken from the consignment meets the respective requirements for the determination of quality characteristics, the sample may be either in split-use or in multiple-use to obtain the test samples for moisture determination and chemical analysis.

5.6 Crushing and grinding

Crushing and grinding shall be conducted with a suitable crusher and grinder for the size and hardness of the ore particles.

The crusher and grinder should be purged with material from the same source.

Table 1 — Application of division method

Division of	Conditions of increment				Manual division method to be applied		Mechanical division method to be applied		
	Sampling		Number of increments composed	CV %	Constant mass division	Fixed-rate division	Constant mass division	Fixed-rate division	
	Method	Type			Increment division method	Riffle division & C/Q	Cutter chute type divider	Cutter chute type divider	Rotary cone type divider
Increment	Manual	Mass-basis		< 20	x	x	x	—	x
	Mechanical			≥ 20	x	—	x	—	—
				< 20	x	x	x	—	x
		≥ 20		x	—	x	—	—	
		Time-basis			—	x	—	x	x
Sub-sample	Manual	Mass-basis	Equal		x	x	x	—	x
				x	x	x	—	x	
	Mechanical		Unequal		—	x	—	—	x
		Time-basis			—	x	—	x	x

C/Q : Coning & quartering method

x : Applicable

— : Not applicable

NOTE — Any of the manual division methods applies to the gross sample.