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Iron ores — Sampling of slurries

Minerais de fer — Échantillonnage des schlamms

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 102, *Iron ore and direct reduced iron*, Subcommittee SC 1, *Sampling*.

This corrected version of ISO 16742:2014 incorporates the following correction:

— In Table 3, third row, the values in the second column ("Up to") have been correctly aligned with the corresponding values in the first column ("Over").

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Iron ores — Sampling of slurries

WARNING — This International Standard may involve hazardous materials, operations, and equipment, and does not purport to address all the safety issues associated with its use. It is the responsibility of the user of this International Standard to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard sets out the basic methods for sampling fine iron ore of nominal top size <1 mm that is mixed with water to form a slurry. At very high ratios of fine solids to water when the material assumes a soft plastic form (about 80 % solids depending on the particle size distribution of the solids), the mixture is correctly termed a paste. Sampling of pastes is not covered in this International Standard.

The procedures described in this International Standard apply to sampling of iron ore that is transported in moving streams as a slurry. These streams can fall freely or be confined in pipes, launders, chutes, spirals, or similar channels. Sampling of slurries in pressurized pipes is not covered in this International Standard. The slurry stream can only be sampled satisfactorily at a transfer point prior to the pressurized pipe at the end of the pipe when the slurry is no longer under pressure. In addition, sampling of slurries in stationary situations, such as a settled or even a well-stirred slurry in a tank, holding vessel, or dam, is not recommended and is not covered in this International Standard.

This International Standard describes procedures that are designed to provide samples representative of the slurry solids and particle size distribution of the slurry under examination. After filtration of the slurry sample, damp samples of the contained solids in the slurry are available for drying (if required) and measurement of one or more characteristics in an unbiased manner and with a known degree of precision. The characteristics are measured by chemical analysis, physical testing, or both.

The sampling methods described are applicable to slurries that require inspection to verify compliance with product specifications, determination of the value of a characteristic as a basis for settlement between trading partners, or estimation of a set of average characteristics and variances that describe a system or procedure.

Provided flow rates are not too high, the reference method against which other sampling procedures are compared is one where the entire stream is diverted into a vessel for a specified time or volume interval, ensuring that all parts of the stream are diverted into the vessel for the same period of time. This International Standard corresponds to the stopped-belt method described in ISO 3082. Reference increments have to be taken as close as possible to increments taken using the sampling procedure under evaluation.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3082, *Iron ores — Sampling and sample preparation procedures*

ISO 3084, *Iron ores — Experimental methods for evaluation of quality variation*

ISO 3085, *Iron ores — Experimental methods for checking the precision of sampling, sample preparation and measurement*

ISO 3087, *Iron ores — Determination of the moisture content of a lot*

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ISO 11323, *Iron ore and direct reduced iron — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11323 apply.

4 General considerations for sampling slurries

4.1 Basic requirements

In this International Standard, a slurry is defined as iron ore of nominal top size <1 mm that is mixed with water, which is frequently used as a convenient form to transport iron ore by means of pumps and pipelines and under gravity in launders or chutes or through long distances in slurry pipelines. Tailings from wet plants are also discharged as a slurry through pipelines to tailings dams. In many of these operations, collection of increments at selected sample points is required for evaluation of the iron ore in the slurry.

A gross or partial sample is constituted from a set of unbiased primary increments from a lot. The sample containers and their contained combined increments are weighed immediately after collection to avoid water loss by evaporation or spillage. Weighing is necessary to determine the percentage of solids mass fraction in the gross sample. The gross or partial sample may then be filtered, dried, and weighed. Alternatively, the gross or partial sample can be sealed in plastic bags after filtering for transport and drying at a later stage.

Test samples are prepared from gross or partial samples after filtering and drying, after breaking up any lumps that have formed during drying using a lump breaker, or forcing the sample through a sieve of appropriate aperture. Test portions may then be taken from the test sample and analysed using an appropriate analytical method or test procedure under prescribed conditions.

The objective of the measurement chain is to determine the characteristic of interest in an unbiased manner with an acceptable and affordable degree of precision. The general sampling theory, which is based on the additive property of variances, can be used to determine how the variances of sampling, sample preparation, and chemical analysis or physical testing propagate and hence determine the total variance for the measurement chain. This sampling theory can also be used to optimize mechanical sampling systems and manual sampling methods.

If a sampling scheme is to provide representative samples, all parts of the slurry in the lot must have an equal opportunity of being selected and appearing in the gross sample for testing. Any deviation from this basic requirement can result in an unacceptable loss of trueness. A sampling scheme having incorrect selection techniques, i.e. with non-uniform selection probabilities, cannot be relied upon to provide representative samples.

Sampling of slurries should preferably be carried out by systematic sampling on a time basis (see Clause 7). If the slurry flow rate and the solids concentration vary with time, the slurry volume and the dry solids mass for each increment will vary accordingly. It needs to be shown that no systematic error (bias) is introduced by periodic variation in quality or quantity where the proposed sampling interval is approximately equal to a multiple of the period of variation in quantity or quality. Otherwise, stratified random sampling should be used (see Clause 8).

Best practice for sampling slurries is to mechanically cut free-falling streams (see Clause 9), with a complete cross section of the stream being taken during the traverse of the cutter. Access to free-falling streams can sometimes be engineered at the end of pipes or by incorporating steps or weirs in launders and chutes. If samples are not collected in this manner, non-uniform concentration of solids in the slurry due to segregation and stratification of the solids can lead to bias in the sample that is collected. Slurry flow in pipes can be homogenous with very fine particles dispersed uniformly in turbulent suspension along the length and across the diameter of the pipe. However, more commonly, the slurry in a pipe will have significant particle concentration gradients across the pipe and there may be concentration fluctuations along the length of the pipe. These common conditions are called heterogeneous flow.

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