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Copper, lead, zinc and nickel concentrates — Sampling of slurries

Concentrés de cuivre, de plomb, de zinc et de nickel — 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 183, *Copper, lead, zinc and nickel ores and concentrates*.

This second edition cancels and replaces the 2010 edition (ISO 11794:2010), of which it constitutes a minor revision. The main changes are the deletion of reference ISO 20212, which has not yet been published, and the replacement of "should" with "shall" where the criteria and/or requirements are mandatory.

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Copper, lead, zinc and nickel concentrates — Sampling of slurries

WARNING — This document may involve hazardous materials, operations and equipment. It is the responsibility of the user of this document to establish appropriate health and safety practices and determine the applicability of any other limitations prior to use.

1 Scope

This document sets out the basic methods for sampling particulate material that is mixed with a liquid, usually water, to form a slurry. In industry and in the mining and mineral processing literature, slurry is also referred to as pulp, but this term is not used in this document. At very high ratios of fine particulate solids to liquids where material assumes a soft plastic form, the mixture is correctly termed as a paste. Sampling of pastes is not covered in this document.

The procedures described in this document apply to sampling of particulate materials that are transported in moving streams as slurries, but not pressurized slurries. These streams may fall freely or be confined in pipes, launders, flumes, sluices, spirals or similar channels. Sampling of slurries in stationary situations, such as a settled or even a well-stirred slurry in a holding vessel or dam, is not recommended and is not covered in this document.

This document describes procedures that are designed to provide samples representative of the slurry solids and particle-size distribution of the slurry under examination. After draining the slurry sample of fluid and measuring the fluid volume, damp samples of the contained particulate material 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 describes a system or procedure.

Provided that 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. This method corresponds to the stopped-belt method described in ISO 12743.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12743, *Copper, lead, zinc and nickel concentrates — Sampling procedures for determination of metal and moisture content*

ISO 12744, *Copper, lead, zinc and nickel concentrates — Experimental methods for checking the precision of sampling*

ISO 13292, *Copper, lead, zinc and nickel concentrates — Experimental methods for checking the bias of sampling*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12743, ISO 12744 and ISO 13292 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Principles of sampling slurries

4.1 General

In this document, a slurry is defined as "any fluid mixture of a solid of nominal top size < 1 mm that is mixed with water, which is frequently used as a convenient form to handle solids in bulk". Slurry flows are found in many mineral processing plants, with the water and entrained solids mixture being transported through the plant circuits by means of pumps and pipelines and under gravity in sluices, flumes and launders. In a number of operations, ore is transported to the mill in slurry form, and in others concentrates are transported long distances in slurry pipelines. Tailings from wet plants are also discharged as slurries through pipelines to the tailings dam. In many of these operations, collection of increments at selected sample points is required for evaluation of the particulate material in the slurry.

A lot sample is constituted from a set of unbiased primary increments from a lot. The sample container is weighed immediately after collection and combination of increments to avoid water loss by evaporation or spillage. Weighing is necessary to determine the percentage of solids by mass in the slurry sample. The sample may then be filtered, dried and weighed. Alternatively, the sample may be sealed in plastic bags after filtering for transport and drying at a later stage. The liquid removed during filtration should be retained if it needs to be analysed.

Test samples are prepared from samples after filtering and drying. Test portions may then be taken from the test sample and analysed using an appropriate and properly calibrated 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 manual sampling methods and mechanical sampling systems.

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 sample for testing. Hence, slurries are to be sampled in such a manner that all possible primary increments in the set into which the slurry can be divided have the same probability of being selected. Any deviation from this basic requirement can result in bias. A sampling scheme with 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 9). If the slurry flow rate and the solids concentration vary with time, the slurry volume and the mass of dry solids 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 10).

Best practice for sampling slurries is to cut freely falling streams mechanically (see Clause 11), with a complete cross-section of the stream being taken during the traverse of the cutter. Access to freely falling streams can sometimes be engineered at the end of pipes or, alternatively, a full-stream sample

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