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Steel and steel products ~~–~~ — Vocabulary relating to chemical analysis

~~DTS stage~~

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Contents

Foreword

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Field Code Changed

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 1, ~~*Method*~~*Methods of determination of chemical composition.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

To ensure that communication in a particular domain is effective and that difficulties in understanding are minimized, it is essential that the various participants use the same concepts and concept representations. Unambiguous communication related to analytical chemistry concepts is crucial given the implications that can arise from misunderstandings with regard to equipment.

~~The standardization of terms and definitions is thus fundamental to all standardization activities.~~
~~This document provides terms and definitions for analytical chemistry concepts dealing with analysis and measurements in support of safe operation and standardization of methods for the determination of chemical composition of steel and cast iron. Terminological data are taken from ISO standards developed and other technically validated documents issued by international organizations.~~
~~Unambiguous communication related to analytical chemistry concepts is crucial taking into account the relevant implications that may arise from misunderstandings with regard to equipment and materials involved in the standards dealing with any subject regarding different method that used and operated for a wide range of applications and requirements and for different kinds of steel and cast iron products.~~
~~In view of the foregoing, a large number of people are involved having different~~Different levels of scientific and technical knowledge~~, thus, it~~ can ~~be~~lead to widely divergent understandings and assumptions about concepts. The result is poor communication that ~~might~~can lead into an increase of the risk of accidents and duplication of efforts as different ~~groups are going to~~ define concepts according to their perspectives.

Conceptual arrangement of terms and definitions is based on concepts systems that show corresponding relationships analytical chemistry concepts. Such arrangement provides users with a structured view of the analytical methods and will facilitate common understanding of all related concepts. Besides, concepts systems and conceptual arrangement of terminological data will be helpful to any kind of user because it will promote clear, accurate and useful communication.

Steel and steel products -- — vocabulary relating to chemical analysis

1 Scope

This document defines terms relating to methods of the determination of the chemical composition of steel and steel products.

~~In other terms, it provides terms and definitions for analytical chemistry concepts dealing with analysis and measurements in support of safe operation and standardization of methods to facilitate communication and promote common understanding.~~

~~3~~2 Normative references

There are no normative references in this document.

~~4~~3 Terms and definitions

~~For the purposes of this document, the following terms and definitions apply.~~

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

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

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

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

~~4.1~~3.1 General terms related to steel and cast iron

3.1.1
alloy steel
steel (3.1.17), other than a stainless steel, that conforms to a specification that requires one or more of the following elements, by mass percent, to have a minimum content equal to or greater than: 0,30 for aluminum; 0,000 8 for boron; 0,30 for chromium; 0,30 for cobalt; 0,40 for copper; 0,40 for lead; 1,65 for manganese; 0,08 for molybdenum; 0,30 for nickel; 0,06 for niobium (columbium); 0,60 for silicon; 0,05 for titanium; 0,30 for tungsten (wolfram); 0,10 for vanadium; 0,05 for zirconium; or 0,10 for any other alloying element, except sulphur, phosphorus, carbon, and nitrogen

[SOURCE: ASTM A941:2018]

3.1.2
austenitic steel
steel (3.1.17) where the structure consists of *austenite* (3.1.3) at ambient temperature

Note 1 to entry: Cast austenitic steels can contain up to about 20 % of *ferrite* (3.1.8).

~~[SOURCE: ISO 4885:2018]~~

~~4.1.1~~
3.1.3
austenite
solid solution of one or more elements in gamma iron (3.1.19~~pure iron with face-centred cubic lattice structure~~)

~~[SOURCE: ISO 4885:2018]~~

~~4.1.2~~
3.1.4
boriding
thermochemical treatment of a workpiece to enrich the surface of a workpiece with boron

Note 1 to entry: The medium in which boriding takes place should be specified, e.g. pack boriding, paste boriding, etc.

~~[SOURCE: ISO 4885:2018]~~

~~4.1.3~~
3.1.5
cast/heat analysis
chemical analysis determined by the steel producer as being representative of a specific heat of *steel* (3.1.17)

Note 1 to entry: Where the analysis reported by the steel producer is not sufficiently complete for conformance with the *heat analysis* (3.1.5) requirements of the applicable product specification to be fully assessed, the manufacturer ~~may~~can complete the assessment of conformance with such *heat analysis* (3.1.5) requirements by using a *product analysis* (3.1.16) for the specified elements that were not reported by the steel producer, provided that *product analysis* (3.1.16) tolerances are not applied and the *heat analysis* (3.1.5) is not altered

[SOURCE: ASTM A941:2018]

~~Or~~

~~chemical analysis representative of the heat, by a method determined at the steelmaker's discretion~~

~~[SOURCE: ISO 404:2013, 3.11, modified.]~~

~~4.1.4~~
3.1.6
cast iron
alloy of iron, carbon and silicon where the carbon content is approximately more than 2 %

~~[SOURCE: ISO 4885:2018]~~

~~4.1.5~~
3.1.7
ductile iron
nodular cast iron
cast iron (3.1.6) that has been treated while molten with an element (usually magnesium or cerium) that spheroidizes the graphite

[SOURCE: ISO 15156-2:2020, 3.5.4]

3.1.8
ferrite
body-centred cubic lattice structure of iron or *steel* (3.1.17)

~~[SOURCE: ISO 4885:2018]~~

~~**4.1.6**~~
3.1.9
forged steel
steel (3.1.17) product obtained by forging and that does not undergo subsequent hot conversion

Note 1 to entry: These products are mainly in the form of ~~rounds~~circles or squares.

~~[SOURCE: ISO 6929:2013]~~

~~**4.1.7**~~
3.1.10
grey cast iron
cast material, mainly iron and carbon based, carbon being present mainly in the form of flake (lamellar) graphite particles

Note 1 to entry: Grey cast iron is also known as flake graphite cast iron, and less commonly as lamellar graphite cast iron.

Note 2 to entry: Graphite form, distribution and size are specified in ~~EN~~ ISO 945-1.

[SOURCE: ~~BS~~ EN 1561:2011, 3.1]

3.1.11
killed steel
steel (3.1.17) deoxidized to such a level that essentially no reaction occurred between carbon and oxygen during solidification

[SOURCE: ASTM A941:2018]

3.1.12
malleable iron
white cast iron (3.1.18) that is thermally treated to convert most or all of the cementite to graphite (temper carbon)

[SOURCE: ISO 15156-2:2020, 3.5.3]

3.1.13
martensite
(phase) formed in carbon containing *steels* (3.1.17) by the cooling of *austenite* (3.1.3) at such a high rate that carbon atoms do not have time to diffuse out of the crystal structure in large enough quantities to form cementite (Fe_3C)

~~[SOURCE: ISO 4885:2018, modified– notes have been omitted]~~

~~4.1.8~~
3.1.14
nitriding
case-hardening process in which nitrogen is introduced into the surface of metallic materials (most commonly ferrous alloys)

EXAMPLE ~~:~~
Liquid nitriding, gas nitriding, ion nitriding and *plasma* (3.6.32) nitriding.

[SOURCE: ISO 15156-2:2020, 3.11]

3.1.15
non-alloyed steel
~~non-alloy steels are those~~steel in which the percentage of each element is less than ~~the~~specific limiting values specified ~~in~~

Note 1 to entry: See Table~~, clause~~ in ~~3.1.2,~~ ISO ~~4948-1~~

~~[SOURCE: ISO~~ 4948-1:1982~~]~~, 3.1.2.

3.1.16
product analysis
chemical analysis carried out on a sample of the product taken after the final hot rolling operation

~~[SOURCE: ISO 404:2013, 3.12, modified.]~~

~~4.1.9~~
3.1.17
steel
ferrous material the principal element of which is iron and the carbon content of which is not more than 2 % of mass

Note 1 to entry: The presence of large quantities of carbide-forming elements can modify the upper limit of the carbon content.

Note 2 to entry: The nomenclature for unalloyed steels suitable for heat treatment and for alloyed steels is ~~defined by~~given in ISO 4948-1 and ISO 4948-2.

~~[SOURCE: ISO 4885:2018]~~

Note 3 to entry: Small amount of alloying elements added to non-alloy steels ~~may~~can cause the product to be defined as a micro-alloy steel.

~~[SOURCE: ISO 4948-2:1981]~~

~~4.1.10~~
3.1.18
white cast iron
cast iron (3.1.6) that displays a white fracture surface due to the presence of cementite

[SOURCE: ISO 15156-2:2020, 3.5.2]

3.1.19

gamma iron
pure iron with face-centred cubic lattice structure

4.23.2 General terms related to preparation of steel and cast iron

3.2.1
grinding
method of preparing a sample of metal for a physical method of analysis in which the surface of the *test sample* (3.3.15) is abraded using an abrasive wheel

[SOURCE: ISO 14284:1996, 3.18]

4.2.1
3.2.2
linishing
method of preparing a sample of metal for a physical method of analysis in which the surface of the *test sample* (3.3.15) is abraded using a flexible rotating disc or continuous belt coated with an abrasive substance

[SOURCE: ISO 14284:1996, 3.19]

4.2.2
3.2.3
milling
method of preparing sample chips or the surface of a sample for a physical method of analysis in which the surface of the sample is machined using a rotating, multi-edged cutting tool

[SOURCE: ISO 14284:1996, 3.20]

4.33.3 General terms related to sample and sampling

3.3.1
aliquot
known amount of a homogeneous material, assumed to be taken with negligible sampling error, the

Note 1 to entre: The term "aliquot" is usually applied to fluids.

Note 1 2 to entry: The term "aliquot" is usually used when the fractional part is an exact divisor of the whole; the term "aliquant" has been used when the fractional part is not exact divisor of the whole (e.g., a 15 ml portion is an aliquant of 100 ml).

Note 2 3 to entry: When a *laboratory sample* (3.3.7) or a *test sample* (3.3.15) is "aliquoted" or otherwise subdivided, the portions have been called split samples.

3.3.2
analyte
component of a system to be analysed

[SOURCE: PAC, 1989, 61, 1657 (Nomenclature for automated and mechanised analysis (Recommendations1989)) on page 1660]Recommendations 1989))]

3.3.3

analytical sample
sample prepared from the *laboratory sample* (3.3.7) and from which analytical portions can be taken

Note 1 to entry: The analytical sample can be subjected to various treatments before an analytical portion is taken.

~~[SOURCE: ISO 15193:2009, 3.3]~~

Note 2 to entry: Where no homogenization or subdivision is necessary, the *laboratory sample* (3.3.7), the *test sample* (3.3.15), and, if the latter requires no further chemical or physical treatment, the analytical samples are identical. With some homogeneous materials such as waters or oils, the *laboratory sample* (3.3.7) may be taken directly from a sample unit and, if no further subdivision or homogenization is carried out, the *laboratory sample* (3.3.7) is the *test sample* (3.3.15). Similarly, with atmospheric particulates collected on a filter, the sample unit is the *laboratory sample* (3.3.7) and, if no further subdivision or homogenization is carried out, also the *test sample* (3.3.15).

[SOURCE: ~~IUPAC orange book: 2002, 10~~ISO 15193:2009, 3.3, modified — Note to entry added.]

3.3.4~~.9~~
consignment
quantity of metal delivered at one time

~~[SOURCE: ISO 14284: 1996, 3.21]~~

~~**4.3.1**~~
3.3.5
duplicate ~~(~~samples
replicate~~)~~ samples
multiple (or two) samples taken under comparable conditions

Note 1 to entry: This selection ~~may~~can be accomplished by taking units adjacent in time or space. Although the replicate samples are expected to be identical, often the only thing replicated is the act of taking the physical sample. A duplicate sample is a replicate sample consisting of two portions. The umpire samples usually used to settle a dispute; the replicate sample is usually used to estimate sample variability.

[SOURCE: PAC, 1990, 62, 1193 (Nomenclature for sampling in analytical chemistry (Recommendations 1990~~) on page 1203]~~)]]

3.3.6
increment
quantity of metal obtained by sampling at one time from a *consignment* (3.3.4)

~~[SOURCE: ISO 14284: 1996, 3.22]~~

~~**4.3.2**~~
3.3.7
laboratory sample
sample or *subsample(s)* (3.3.13) sent to or received by the laboratory

Note 1 to entry: When the laboratory sample is further prepared (reduced) by subdividing, mixing, *grinding* (3.2.1), or by combinations of these operations, the result is the *test sample* (3.3.15). When no preparation of the laboratory sample is required, the laboratory sample is the *test sample* (3.3.15). A *test portion* (3.3.14) is removed from the *test sample* (3.3.15) for the performance of the test or for analysis.

Note 2 to entry: The laboratory sample is the final sample from the point of view of sample collection but it is the initial sample from the point of view of the laboratory.

Note 3 to entry: Several laboratory samples ~~may~~can be prepared and sent to different laboratories or to the same laboratory for different purposes. When sent to the same laboratory, the set is generally considered as a single laboratory sample and is documented as a single sample.

[SOURCE: IUPAC orange book: 2002, 18.3.6, Sampling stages]

3.3.8
lot
quantity of material ~~which~~that is assumed to be a single population for sampling purposes

[SOURCE: PAC, 1990, 62, 1193 (Nomenclature for sampling in analytical chemistry (Recommendations 1990~~)) on page 1201~~)]]

~~**PAC, 1988, 60, 1461(Nomenclature, symbols, units and their usage in spectrochemical analysis-X. Preparation of materials for analytical atomic *spectroscopy* (3.3.9**~~
~~3.5.26) and other related techniques (Recommendations 1988)) on page 1463]~~

~~**4.3.3**~~
matrix
~~(in analysis)~~ components of the sample other than the *analyte* (3.3.2)

Note 1 to entry. In analysis.

[SOURCE: PAC, 1989, 61, 1657 (Nomenclature for automated and mechanised analysis (Recommendations 1989~~)) on page 1660~~)]]

3.3.10
primary sample
collection of one or more *increments* (3.3.6) or units initially taken from a population

Note 1 to entry: The portions ~~may~~can be either combined (composited or bulked sample) or kept separate (gross sample). If combined and mixed to homogeneity, it is a blended bulk sample.

Note 2 to entry: The term "bulk sample" is commonly used in the sampling literature as the sample formed by combining *increments* (3.3.6). The term "bulk sample" is ambiguous since it could also mean a sample from a bulk *lot* (3.3.8) and it does not indicate whether the *increments* (3.3.6) or units are kept separate or combined. Such use should be discouraged because less ambiguous alternative ~~terms~~expressions (composite sample, aggregate sample) are available.

Note 3 to entry: "Lot sample" and "batch sample" have also been used for this concept, but they are self-limiting terms.

Note 4 to entry: The use of "primary" in this sense is not meant to imply the necessity for multistage sampling.

[SOURCE: IUPAC orange book: 2002, 18.3.6, Sampling stages]

3.3.11
representative sample
sample that has the same properties as a defined batch of material and represents the bulk material, within a defined confidence limit

