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Solid mineral fuels — Vocabulary —

Part 2: Terms relating to sampling, testing and analysis

Combustibles minéraux solides — Vocabulaire —

Partie 2: Termes relatifs à l'échantillonnage, l'essai et l'analyse

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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The committee responsible for this document is ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 1, *Coal preparation: Terminology and performance*.

This second edition cancels and replaces the first edition (ISO 1213-2:1992), which has been technically revised.

A list of all parts in the ISO 1213 series can be found on the ISO website.

Solid mineral fuels — Vocabulary —

Part 2: Terms relating to sampling, testing and analysis

1 Scope

This document defines terms commonly employed in the sampling, testing and analysis of solid mineral fuels.

Alternative names are given for several terms. In some cases, however, the use of the alternative name is deprecated (as indicated).

An alphabetical index, with numerical cross reference is provided.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

3.1
abrasion
loss of material from particle surfaces of a solid mineral fuel, or from other surfaces in contact with the particles, caused by friction between contacting surfaces

3.2
abrasion index
total mass lost by the *abrasion* (3.1) of four carbon steel blades when rotated in a specified mass of a solid mineral fuel under specified conditions

Note 1 to entry: Expressed in milligrams of metal lost per kilogram of solid mineral fuel.

3.3
abrasion value
resistance to *abrasion* (3.1) of the *coke* (3.42) after reaction with carbon dioxide in the CRI test, measured as the percentage of a sample passing through a 0,5 mm sieve after tumbling under conditions specified

3.4
adiabatic calorimeter
calorimeter that adjusts its jacket temperature constantly to be identical to bomb temperature, thereby preventing heat losses

Note 1 to entry: The inner calorimeter chamber and the jacket exchange no energy because the water temperature in both is identical during the test. The water in the external jacket is heated or cooled to match the temperature change in the calorimeter proper.

3.5
accuracy
closeness of agreement between an observation and the "true" value

Note 1 to entry: The accuracy of a result should not be confused with its precision. A result may be precise but it is only accurate when it is free of *bias* (3.18).

3.6
adventitious ash
DEPRECATED: extraneous ash
ash arising from *mineral matter* (3.136) associated with, but not inherent in, a solid mineral fuel

3.7
air-dried basis
means of expressing an analytical result based on the condition in which a solid mineral fuel is in equilibrium with atmospheric humidity

3.8
air-drying
process of bringing the moisture content of the sample near to equilibrium with the atmosphere, in the area in which further reduction of the sample are to take place

Note 1 to entry: The solid mineral fuel in this state is composed of absorbed moisture, mineral matter and organic matter.

3.9
anthracite
coal (3.39) of high *rank* (3.174), with a low *volatile matter* (3.239) content and a semi-metallic lustre, and which does not soften or swell when heated

3.10
apparent relative density
ratio of the mass of a fuel (lump sample) to the mass of an equal volume of water (at the same temperature), inclusive of any voids within the fuel subjected to the test

Note 1 to entry: The apparent relative density should not be confused with the *bulk density* (3.25).

3.11
ash
residue obtained by incineration of a solid mineral fuel under specified conditions

3.12
ash analysis
analysis of *ash* (3.11) for its elemental composition

Note 1 to entry: The elements usually determined are silicon, aluminium, iron, magnesium, manganese, titanium, calcium, sodium, potassium, phosphorus and sulfur, and these are usually expressed as oxides.

3.13
ash fusibility
characteristic physical state of the *ash* (3.11) obtained by heating under specified conditions

Note 1 to entry: Ash fusibility is determined under either oxidizing or *reducing atmosphere* (3.176) conditions.

Note 2 to entry: See also deformation temperature, *sphere temperature* (3.215), *hemisphere temperature* (3.98) and *flow temperature* (3.75).

3.14
ash viscosity
measure of the resistance to flow of *ash* (3.11) in the fused state

3.15
as received basis
as sampled basis
means of expressing an analytical result based on the condition where *total moisture* (3.232) is included

3.16
base/acid ratio
ratio of the mass of basic oxides (iron(III) oxide, calcium oxide, magnesium oxide, disodium oxide and dipotassium oxide) to the mass of acidic oxides (silica, aluminium oxide and titanium (IV) oxide) in *ash* (3.11)

Note 1 to entry: This ratio can be used in the determination of the *fouling factor* (3.81) and the slagging factor.

3.17
batch
quantity of a solid mineral fuel produced at one time under relatively uniform conditions

3.18
bias
systematic *error* (3.68) which leads to the average value of a series of results being persistently higher or persistently lower than those obtained using a reference sampling method

Note 1 to entry: Bias is the total systematic error as contrasted to random error. There may be one or more systematic error components contributing to the bias. A larger systematic difference from the accepted reference value is reflected by a larger bias value.

3.19
bias of scale
bias (3.18) that is constant and independent of the range of values measured

3.20
bituminous coal
general descriptive term for *coal* (3.39) of *rank* (3.174) between *anthracite* (3.9) and *brown coal and lignite* (3.24)

Note 1 to entry: The vitrinites in all coals in the bituminous range melt and form a coke when the coal is heated above 400 °C in the absence of air.

Note 2 to entry: In some countries, coals of rank immediately below that of bituminous coal are referred to as sub-bituminous coals.

3.21
blast furnace coke
strong, *large coke* (3.116) for use in blast furnaces

Note 1 to entry: Blast furnace coke is generally produced from blends of *bituminous coals* (3.20), which may incorporate additives.

Note 2 to entry: Blast furnace coke usually has a low reactivity to carbon dioxide.

3.22
breakage
particle size reduction (3.155) resulting from impact and/or compression

3.23
breeze
undersize after separating the smallest size of *graded coke* (3.91)

Note 1 to entry: Breeze is usually less than 10 mm in size.

3.24
brown coal and lignite
coals (3.39) of low *rank* (3.174) characterized by high inherent moisture, high *volatile matter* (3.239) and low calorific value

Note 1 to entry: In some countries, the terms are used to describe all low-rank coals up to *bituminous coals* (3.20). In other countries, the coals at the higher end of the range are referred to as sub-bituminous coals.

3.25
bulk density
mass of a portion of a solid mineral fuel divided by the volume of the container which is filled by that portion under specified conditions

Note 1 to entry: Bulk density values can have range and may depend on previous handling, time and weather. The values on stockpiles can also vary from loose free fall situations to compacted filled by that portion under specified conditions.

3.26
bulk sample
sample of large mass, taken in a particular operation for a specific reason such as for *float sink analysis* (3.78)

3.27
caking of coal
property of *coal* (3.39) when heating without access of air to a plastic condition with formation of the connected non-volatile residue

3.28
caking index
measure of the caking power of a coal in terms of the *mechanical strength* (3.132) of the *coke* (3.42) obtained by carbonization, under specified conditions, of an intimate mixture of the *coal* (3.39) and standard *anthracite* (3.9)

3.29
calorific value gross at constant volume
absolute value of the specific energy of combustion, in joules, for unit mass of a solid fuel burned in oxygen in a calorimetric bomb under the conditions specified

Note 1 to entry: The products of combustion are assumed to consist of gaseous oxygen, nitrogen, carbon dioxide and sulfur dioxide, of liquid water (in equilibrium with its vapour) saturated with carbon dioxide under the conditions of the bomb reaction, and of solid ash, all at the reference temperature.

Note 2 to entry: Equipment such as Adiabatic and or Isothermal bomb calorimeters are used to determine this result.

3.30
calorific value net at constant volume
absolute value of the specific energy of combustion, in joules, for unit mass of the fuel burned in oxygen under conditions of constant volume and such that all the water of the reaction remains as water vapour (in a hypothetical state at 0,1 Mpa), the other products being as for the gross calorific value all at the reference temperature

Note 1 to entry: The net calorific value at constant volume is the negative value of the net specific energy of combustion.

3.31
calorific value net at constant pressure
absolute value of the specific heat (enthalpy) of combustion in joules, for unit mass of the fuel burned in oxygen at constant pressure under such conditions that all the water of the reaction products remains as water vapour (at 0,1 Mpa), the other products being as for the gross calorific value, all at the reference temperature

3.32
carbominerite
collective term for inter growths of minerals and *macerals* (3.121)

Note 1 to entry: The various types of carbominerite with their compositions are given in Table 1.

Table 1 — Types and compositions of carbominerite

Type	Volume percentage of minerals
Carbargilite	20 to 60, clay minerals
Carbopyrite	5 to 20, sulfides
Carbankerite	20 to 60, carbonates
Carbosilicite	20 to 60, quartz
Carbopolyminerite[a]	20 to 60, various minerals
[a] The term is used also for carbopolyminerite containing a maximum of 5 % of mineral matter, provided that sulfides form a substantial part of the mineral matter.	

3.33
carbon in mineral matter
carbon in the mineral matter carbonates of a solid mineral fuel

3.34
carboxyreactivity
rate of reaction of a solid mineral fuel with carbon dioxide under specified conditions

3.35
channel sample
sample of raw *coal* (3.39) and associated inorganic material taken by removing a channel of even cross-section from the seam

Note 1 to entry: Where the full section of the seam is not accessible or not required, this term may refer to a sample taken either from a specifically defined portion of the seam, or from the floor to roof as mined or exposed.

3.36
char
solid, partially or non-agglomerated carbonaceous material produced by the pyrolysis of solid mineral fuels

3.37
chute
inclined trough for conveying solid mineral fuel to a lower level

3.38
clinkering
aggregation of particles of *ash* (3.11) after it has melted during the course of combustion of a solid mineral fuel or during gasification

Note 1 to entry: The aggregated particles may include small amounts of unburnt solid mineral fuel.

3.39
coal
combustible sedimentary rock formed from altered plant remains consolidated under superimposed strata

Note 1 to entry: The characteristics of different coals are due to differences in source plant material, in the conditions and the degree of change that the material has undergone in its geological history, and in the range of impurities present. Coals can be characterized macroscopically by their lithotype composition and microscopically by their maceral and *microlithotype* (3.123) compositions.

3.40
coalification
process by which accumulated plant matter is compacted and transformed into *coal* (3.39)

3.41
coefficient of variation
standard deviation (3.216), expressed as a percentage of the absolute value of the arithmetic mean

$$CV = \frac{s}{\bar{x}} \times 100\ \%$$

where *CV* is normally denoted as *v*.

3.42
coke
solid, agglomerated carbonaceous residue produced by the pyrolysis of *coal* (3.39) in the absence of air

3.43
coke reactivity index
CRI
percentage weight loss of *coke* (3.42) after reaction with carbon dioxide and carbon monoxide under specified conditions

3.44
coke strength after reaction
CSR
strength of *coke* (3.42) after reaction with carbon dioxide and carbon monoxide in the CRI test, measured as the percentage retained on either a 10,0 mm or a 9,5 mm sieve after tumbling under specified conditions

3.45
combustible matter
theoretical state of a solid mineral fuel without moisture and *mineral matter* (3.136) other than *pyritic sulfur* (3.170) and sulfidic sulfur

3.46
combustible sulfur
sulfur which reacts with oxygen when a solid mineral fuel is burnt under specified controlled conditions

Note 1 to entry: Most of the reacted sulfur reports as SO_2 in the chimney gas, but under certain conditions, some of the sulfur is captured by alkaline minerals in the ash

3.47
common sample
sample collected for more than one intended use

3.48
complete seam profile sample for each bench
collective designation of the coal samples taken separately from each coal bench and band of the tested seam or a part of it which is a section of a thick seam

3.49
constant mass division
method of increment or *sample division* (3.194) in which the portions retained from individual *increments* (3.106), *partial samples* (3.153) or *gross samples* (3.94) are of uniform mass

3.50
continuous sampling
taking of a sample from each consecutive *sub-lot* (3.221) so that *increments* (3.106) are taken at uniform intervals whenever the fuel is handled at the point of sampling

3.51
correlation coefficient
measure of the degree of correlation between the members of paired sets

3.52
core sample
cylindrical sample of the whole or part of a coal seam obtained from drilling using a coring barrel

Note 1 to entry: The diameter of the core may vary from 50 mm to 1000 mm depending on the reason for which the sample is required. However, 50 mm to 200 mm is the most common core diameter range.

3.53
crucible swelling number
CSN
number which defines, by reference to a series of standard profiles, the size and shape of the residue obtained when a specified mass of *coal* (3.39) is heated in a covered crucible under specified conditions

Note 1 to entry: ASTM Standards use the term free swelling index (FSI) for this test.

3.54
crush (verb)
action of reducing the particle size of a sample to produce particles at the required *nominal top size* (3.144) required

Note 1 to entry: See also grind (3.93).

3.55
cut coke
screened *coke* (3.42) from which the oversize has been reduced by mechanical means and rescreened

3.56
cutter
mechanical sampling device which extracts *increments* (3.106)

3.57
deformation interval
softening interval
interval between the *deformation temperature* (3.58) and the *hemisphere temperature* (3.98)

3.58
deformation temperature
temperature at which deformation of a test piece prepared from *ash* (3.11), by a specified procedure, occurs

Note 1 to entry: When using cylindrical (or cubicoidal) test pieces, a change of the surface and the rounding of the edges at the rim or corner.

Note 2 to entry: When using pyramidal test pieces, the rounding of the tip of the test piece. Shrinkage or distortion of the test piece, or rounding of cracks and fins, are not criteria for deformation and should be ignored if the tip and edges remain sharp.

3.59
dial divisions per minute
ddpm
measure of stirrer rotation rate, in the Gieseler Plastometer method

Note 1 to entry: There are 100 dial divisions for each full 360° rotation of the stirrer. The *fluidity* (3.77) result is expressed as total dial division turned by the stirrer in a one-minute time period

3.60
dilatation
measure of the volume change produced by heating a *coal* (3.39) through its *plastic range* (3.162) under specified conditions

Note 1 to entry: Similar tests with their own specified conditions have been developed historically, including Audibert-Arnu and the Ruhr Coal test.

3.61
dirt band
DEPRECATED: shale band
layer of *mineral matter* (3.136) lying parallel to the bedding plane in a seam of *coal* (3.39)

3.62
divided increment
part obtained from the division of the *increment* (3.106) in order to decrease its mass

Note 1 to entry: Such division may be done with or without prior size reduction.

3.63
dry ash-free basis
means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be free from both moisture and *ash* (3.11)

3.64
dry basis
means of expressing an analytical result based on the condition in which the solid mineral fuel is free from moisture

3.65
dry mineral-matter-free basis
means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be free from both moisture and *mineral matter* (3.136)

3.66
duplicate determination
determination of a characteristic on two portions of the same *test sample* (3.226) carried out by the same operator using the same apparatus but at different times

3.67
duplicate sampling
particular case of *replicate sampling* (3.185) with only two replicate samples

3.68
error
difference between the observation and the accepted reference value as defined in ISO 5725-1:1994

3.69
falling stream
stream of solid mineral fuel in free fall, for example, from the end of a conveyor

3.70
final fluidity temperature
temperature at which stirrer rotation rate reached 1 ddpm in the Gieseler Plastometer test

3.71
fixed carbon
remainder after the percentages of the moisture in the analysis sample, *ash* (3.11) and *volatile matter* (3.239) are subtracted from 100 reported on an air-dried basis

Note 1 to entry: Fixed carbon may also be calculated to different bases.

3.72
fixed mass division
method of *sample division* (3.194) in which the mass retained is predetermined and independent of the mass of the feed

3.73
fixed rate division
method of increment or *sample division* (3.194) in which the portions retained from individual *increments* (3.106), *partial samples* (3.153) or *gross samples* (3.94) have a mass proportional to the mass of the increment, partial sample or gross sample

Note 1 to entry: In fixed rate division, the mass of sample retained is a fixed proportion of the mass of the feed.

3.74
fixed sulfur
sulfur which is present in the solid residue (non-volatile) after the pyrolysis of a solid mineral fuel at a particular temperature

3.75
flow temperature
temperature at which a test piece, prepared from *ash* (3.11) by a specified procedure, loses its profile and flows to the extent that its height is one third of its height at the *hemisphere temperature* (3.98)

3.76
flattened-heap method
method of *sample division* (3.194) in which a sample is flattened and divided into identical rectangles and from each rectangle, one *increment* (3.106) is taken using a scoop and bump plate and combined into a divided sample

3.77
fluidity
measure of the viscosity of a *coal* (3.39) in its plastic state determined under specified conditions

3.78
float sink analysis
laboratory procedure for analysing raw coal samples, using organic and/or other high specific gravity solutions adjusted to various gravities to predict *ash* (3.11) levels and yield for coal product(s) and reject(s) in a coal preparation plant

3.79
formed coke
coke (3.42) specially prepared from *coal* (3.39) by processes involving the compaction of particles into a regularly shaped artefact

3.80
forms of sulfur
collective term for the *pyritic sulphur* (3.170), *sulfate sulfur* (3.222) and *organic sulfur* (3.149) in a solid mineral fuel

Note 1 to entry: For the purposes of this definition, elemental sulfur and monosulfides, which may be present in certain solid mineral fuels, are disregarded.

3.81
fouling factor
measure of the tendency of *ash* (3.11) to form sintered deposits in the convective zone of a furnace

3.82
fouling index
empirical estimate of the fouling propensity of coal ash