INTERNATIONAL STANDARD

ISO 1213-2

First edition
1992-04-01

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 du charbon

Reference number
ISO 1213-2:1992(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1213-2 was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels*.

It cancels and replaces ISO Recommendations R 1213-2:1971 and R 1213-3:1971, of which it constitutes a technical revision.

ISO 1213 consists of the following parts, under the general title *Solid mineral fuels — Vocabulary*:

— *Part 1: Terms relating to coal preparation*

— *Part 2: Terms relating to sampling, testing and analysis*

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Solid mineral fuels — Vocabulary —

Part 2:
Terms relating to sampling, testing and analysis

1 Scope

This part of ISO 1213 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

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1213. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1213 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings.*

ISO 3310-1:1990, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth.*

3 Terms and definitions

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: The total mass lost by the *abrasion* of four carbon steel blades when rotated in a specified mass of a solid mineral fuel under specified conditions, expressed in milligrams of metal lost per kilogram of solid mineral fuel.

3.3 accuracy: The closeness of agreement between an observation and the "true" value.

NOTE 1 The accuracy of a result should not be confused with its *precision*.

3.4 adventitious ash; extraneous ash (deprecated): *Ash* arising from *mineral matter* associated with, but not inherent in, a solid mineral fuel.

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

NOTE 2 The solid mineral fuel in this state is composed of residual moisture, *mineral matter* and organic matter.

3.6 anthracite: *Coal* of high *rank*, with a low *volatile matter* content and a semi-metallic lustre, and which does not soften or swell when heated.

3.7 apparent relative density: The ratio of the mass of a dry solid mineral fuel to the mass of a volume of water equal to the apparent volume of the solid mineral fuel at a specified temperature.

NOTE 3 The apparent relative density should not be confused with the *bulk density* (see 3.21).

3.8 ash: The residue obtained by incineration of a solid mineral fuel under specified conditions.

3.9 ash analysis: The analysis of *ash* for its elemental composition.

NOTE 4 The elements usually determined are silicon, aluminium, iron, magnesium, titanium, calcium, sodium, potassium, phosphorus and sulfur, and these are usually expressed as oxides.

3.10 ash fusibility: Characteristic physical state of the *ash* obtained by heating under specified conditions.

NOTES

5 Ash fusibility is determined under either oxidizing or reducing conditions.

6 See also *deformation interval* (3.43), *deformation temperature* (3.44), *flow temperature* (3.58), *hemisphere temperature* (3.76) and *melting interval* (3.100).

3.11 ash viscosity: A measure of the resistance to flow of *ash* in the fused state.

3.12 base/acid ratio: The 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*.

NOTE 7 This ratio can be used in the determination of the *fouling factor* and the *slagging factor*.

3.13 batch: A quantity of a solid mineral fuel produced at one time under relatively uniform conditions.

3.14 bias: A systematic *error* which leads to results which are persistently higher or persistently lower than the "true" value.

3.15 bituminous coal: A general descriptive term for *coal* of *rank* between *anthracite* and *brown coal/lignite*.

NOTES

8 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.

9 In some countries coals of *rank* immediately below that of *bituminous coal* are referred to as sub-bituminous coals.

3.16 blast furnace coke: Strong, large *coke* for use in blast furnaces.

NOTES

10 Blast furnace coke is generally produced from blends of *bituminous coals*, which may incorporate additives.

11 Blast furnace coke usually has a low *reactivity* to carbon dioxide.

3.17 bottom size; lower size: The size corresponding to the 95 percentile on the cumulative *size distribution* curve of a material, i.e. the largest sieve size on which 95 % of the material is retained.

3.18 breakage: *Particle size reduction* resulting from impact and/or compression.

3.19 breeze: The undersize after separating the smallest size of *graded coke*.

NOTE 12 Breeze is usually less than 10 mm in size.

3.20 brown coal and lignite: Coals of low *rank* characterized by high inherent moisture, high *volatile matter* and low calorific value.

NOTE 13 In some countries the terms are used to describe all low *rank* coals up to *bituminous coals*. In other countries the coals at the higher end of the range are referred to as sub-bituminous coals.

3.21 bulk density: The 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.

3.22 carbominerite: Collective term for intergrowths of minerals and *macerals*.

NOTE 14 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[1)]	20 to 60, various minerals

1) 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.

3.23 carbon in mineral matter: The carbon in the *mineral matter* carbonates of a solid mineral fuel.

3.24 carboxyreactivity: The rate of reaction of a solid mineral fuel with carbon dioxide under specified conditions.

3.25 char: The solid, partially or non-agglomerated carbonaceous material produced by the pyrolysis of solid mineral fuels.

3.26 chute: An inclined trough for conveying solid mineral fuel to a lower level.

3.27 clinkering: The aggregation of particles of *ash* after it has melted during the course of combustion of a solid mineral fuel or during gasification.

NOTE 15 The aggregated particles may include small amounts of unburnt solid mineral fuel.

3.28 coal: Combustible sedimentary rock formed from altered plant remains consolidated under superimposed strata.

NOTE 16 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* compositions.

3.29 coalification: Process by which sedimented compacted plant remains are transformed into *coal*.

NOTE 17 This process is characterized by an increase in the carbon content in the plant remains and a decrease in the *volatile matter* yield from the plant remains. As coalification proceeds, the *reflectances* of the *macerals* tend to increase. Vitrinite is used as a reference material for the determination of the *rank* of *coal* because its *reflectance* increases uniformly with the extent of coalification.

3.30 coefficient of variation: The *standard deviation*, s, expressed as a percentage of the absolute value of the arithmetic mean, $|\bar{x}|$

$$v = \frac{s}{|\bar{x}|} \times 100$$

NOTE 18 This term is usually designated as v.

3.31 coke: The solid, agglomerated carbonaceous residue produced by the pyrolysis of *coal* in the absence of air.

3.32 combustible matter: Theoretical state of a solid mineral fuel without moisture and *mineral matter* other than *pyritic sulfur* and sulfidic sulfur.

3.33 combustible sulfur: The sulfur which reacts with oxygen when a solid mineral fuel is burnt under specified controlled conditions.

3.34 common sample: A *sample* collected for more than one intended use.

3.35 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.

3.36 coning and quartering: An operation in which the thoroughly mixed material is piled into a conical heap on a clean, dry, non-absorbent surface, then flattened into a uniform circular layer and divided into four equal portions by cuts at right angles, one pair of opposite quarters being retained while the other pair is rejected.

3.37 constant mass division: The method of increment or *sample division* in which the portions retained from individual *increments*, *partial samples* or *gross samples* are of uniform mass.

3.38 continuous sampling: The taking of a *sample* from every unit of the solid mineral fuel being handled.

3.39 correlation coefficient: A measure of the degree of correlation between the members of paired sets.

3.40 crucible swelling number: The 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* is heated in a covered crucible under specified conditions.

3.41 crush (to): To reduce the *particle size* of a *sample* to produce mainly coarse particles.

NOTE 19 See also *to grind* (3.70).

3.42 cut coke: Screened *coke* from which the oversize has been reduced by mechanical means and rescreened.

3.43 deformation interval; softening interval: The interval between the *deformation temperature* and the *hemisphere temperature*.

3.44 deformation temperature: The temperature at which deformation of a test piece prepared from ash, by a specified procedure, occurs.

NOTE 20 The deformation observed takes the following forms:

a) when using cylindrical (or cubicoidal) test pieces, a change of the surface and the rounding of the edges at the rim or corner;

b) when using pyramidal test pieces, the rounding of the tip of the test piece.

3.45 dilatation: A measure of the volume change produced by heating a *coal* through its plastic range under specified conditions.

3.46 dirt band; shale band (deprecated): A layer of *mineral matter* lying parallel to the bedding plane in a seam of *coal*.

3.47 divided increment: The part obtained from the division of the *increment* in order to decrease its mass.

NOTE 21 Such division may be done with or without prior size reduction.

3.48 dry ash-free basis: A 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*.

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

3.50 dry mineral-matter-free basis: A 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*.

3.51 duplicate determination: The determination of a characteristic on two portions of the same *test sample* carried out by the same operator using the same apparatus but at different times.

3.52 duplicate sampling: A particular case of *replicate sampling* with only two replicate samples.

3.53 error: The difference between the observation and the "true" value, which can be designated systematic (*bias*) or random.

3.54 falling stream: A stream of solid mineral fuel in free fall, for example from the end of a conveyor.

3.55 fixed carbon: The remainder after the percentages of the moisture, *ash* and *volatile matter* are subtracted from 100.

3.56 fixed rate division: The method of increment or *sample division* in which the portions retained from individual *increments*, *partial samples* or *gross samples* have a mass proportional to the mass of the *increment*, *partial sample* or *gross sample*.

3.57 fixed sulfur: The sulfur which is present in the solid residue (non-volatile), after the pyrolysis of a solid mineral fuel at a particular temperature.

3.58 flow temperature: The temperature at which a test piece, prepared from *ash* 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*.

3.59 fluidity: A measure of the viscosity of a *coal* in its plastic state determined under specified conditions.

3.60 formed coke: *Coke* specially prepared from *coal* by processes involving the compaction of particles into a regularly shaped artifact.

3.61 forms of sulfur: A collective term for the *pyritic sulfur*, *sulfate sulfur* and *organic sulfur* in a solid mineral fuel.

NOTE 22 For the purposes of this definition, elemental sulfur and monosulfides, which may be present in certain solid mineral fuels, are disregarded.

3.62 fouling factor: A measure of the tendency of *ash* to form sintered deposits in the convective zone of a furnace.

3.63 foundry coke: Very strong, very large, dense *coke* for use in foundry cupola furnaces.

NOTE 23 It is prepared in coke ovens from selected coking coal blends, and may incorporate additives.

3.64 free moisture: The moisture which is lost by the solid mineral fuel *sample* in attaining approximate equilibrium with the atmosphere to which it is exposed.

3.65 gas coke: *Coke* usually made from high volatile *bituminous coal* at high temperature in gas-making carbonization plants.

3.66 general analysis: The determination of the chemical and physical characteristics of a solid mineral fuel, other than the determination of *total moisture*.

3.67 general analysis test sample: A *sample*, crushed to pass a sieve, of nominal size of openings 212 µm, complying with ISO 3310-1, used for the determination of most physical and chemical characteristics of a solid mineral fuel.

3.68 graded coke: *Coke* which has been screened between two specified sizes.

3.69 Gray-King coke type: The type, denoted by a letter, with a subscript in certain cases, which defines, by reference to a series of standard profiles, the size, strength and texture of the coke residue obtained when a specified mass of *coal* is heated in a retort tube under specified conditions.

3.70 grind (to); mill (to) (deprecated): To reduce the *particle size* of a *sample* to produce fine particles.

NOTE 24 See also *to crush* (3.41).

3.71 gross calorific value at constant volume: The amount of heat liberated per unit mass of a solid mineral fuel when it is burned in oxygen saturated with water vapour in a bomb calorimeter under specified conditions.

NOTE 25 The gross calorific value at *constant volume* is the negative value of the gross specific energy of combustion.

3.72 gross sample: The quantity of a solid mineral fuel consisting of all the *increments* or *partial samples* taken from a *sampling unit*, either in the condition as taken or after the *increments* have been individually reduced and/or divided.

3.73 hand placing: The operation by which an attempt is made to pass each particle of solid mineral fuel through a stationary sieve by presenting it to the sieve in all possible orientations but without the use of force.

3.74 hand shaking; manual shaking: The operation in which a sieve is held in the hands and is given a gentle horizontal oscillatory motion.

3.75 Hardgrove grindability index: A measure of the grindability of a *coal* determined by testing a specially prepared sample in standard apparatus.

3.76 hemisphere temperature: The temperature at which the height of a test piece, prepared from *ash* by a specified procedure, is equal to half the width of the base, and its shape becomes approximately hemispherical.

3.77 high temperature coke: The solid, agglomerated carbonaceous residue of the pyrolysis of *coal* at temperatures above 850 °C.

3.78 humic acids: A group of complex organic, amorphous compounds of high relative molecular mass which occur as free acids and as metal salts (humates).

3.79 hydrogen in mineral matter: The hydrogen in the *water of constitution* in the *mineral matter* of a solid mineral fuel.

3.80 hydroreactivity: The rate of reaction of a solid mineral fuel with water vapour under specified conditions.

3.81 hygroscopic moisture of brown coals and lignites: The part of *total moisture* which is retained by a *brown coal or lignite* after exposing it to the atmosphere and allowing it to attain a constant mass, at 20 °C ± 2 °C and (70 ± 5) % relative humidity.

3.82 ignition temperature: The minimum temperature at which a solid mineral fuel liberates enough *volatile matter* to form, together with the surrounding atmosphere, a flammable mixture.

3.83 increment: A portion of a solid mineral fuel collected in a single operation of the sampling instrument.

NOTE 26 For some types of sampling instrument, a single operation consists of a double pass (back and forth) through the stream.

3.84 inerts (inorganic): Constituents of a solid mineral fuel which decrease its efficiency in a specific use.

3.85 inerts (organic): The *maceral* components of a *coal* which do not soften or swell during the process of carbonization.

3.86 inherent ash: *Ash* arising from *mineral matter* present in the original plant material from which the solid mineral fuel was formed and from *mineral matter* incorporated intimately in the solid mineral fuel during the *coalification* process.

3.87 intermittent sampling: The taking of a *sample* from only certain units of the solid mineral fuel being handled.

3.88 Irsid indices: The percentages of a specially prepared sample of *coke* remaining on a test sieve of 40 mm nominal size of openings (round hole) and passing a test sieve of 10 mm nominal size of openings (round hole), denoted by I_{40} and I_{10} respectively, after the sample has been subjected to 500 revolutions by a specified procedure in a rotating drum.

NOTE 27 Other indices, for example I_{20}, may be reported in addition to, or in place of, I_{40} if required.

3.89 laboratory sample: A *sample* prepared from the *gross* or *partial sample* as delivered to the laboratory and from which further samples are prepared for test purposes.

3.90 large coal: *Coal* above a specified lower limiting size, without any upper size limit.

3.91 large coke: *Coke* with lower size of 20 mm and above, with or without upper size limit.

3.92 lot: A discrete quantity of a solid mineral fuel for which the overall quality needs to be determined.

3.93 low temperature coke: The solid, agglomerated carbonaceous residue of the pyrolysis of *coal* at a temperature between 500 °C and 850 °C.

3.94 lump section: A piece of solid mineral fuel of size suitable for polishing and examination under the microscope.

NOTE 28 One face of the lump section, usually that perpendicular to the bedding plane, is ground and polished.

3.95 maceral: Microscopically recognizable organic constituent of *coal* analogous to the minerals of inorganic rocks, but differing from them in that a maceral has no characteristic crystal form and is not constant in chemical composition.

NOTES

29 The macerals are distinguished from one another, microscopically on the basis of their differences in such properties as *reflectance*, colour, morphology, size and hardness. They originate from the remains of different tissues of plants and their physical and chemical properties change as *coalification* proceeds.

30 The classification of the macerals in *bituminous coal* and *anthracite* is given in table 2.

3.96 maceral group: Collective term for *macerals* having broadly similar properties in a single *coal* of specific *rank*.

NOTE 31 Three maceral groups are recognized: vitrinite (huminite in brown coal), liptinite and inertinite. The *maceral groups* in *bituminous coal* and *anthracite*, and their subdivisions, are given in table 2.

Table 2 — Maceral groups in bituminous coal and anthracite and their subdivisions

Maceral group	Maceral	Submaceral
Vitrinite	Telinite	Telinite 1
		Telinite 2
	Collinite	Telocollinite
		Gelocollinite
		Desmocollinite
		Corpocollinite
	Vitrodetrinite	
Liptinite[1)]	Sporinite	
	Cutinite	
	Resinite	
	Suberinite[2)]	
	Alginite	
	Liptodetrinite	
	Bituminite	
Inertinite	Micrinite	
	Macrinite	
	Semifusinite	
	Fusinite	Pyrofusinite
		Degradofusinite
	Sclerotinite	
	Inertodetrinite	

1) This maceral group has also been referred to as exinite but the use of this term is now deprecated.

2) Occurs in post-carboniferous bituminous coals.

3.97 mass basis sampling: The taking of *increments* in uniform mass intervals throughout the *sampling unit*.

NOTE 32 Each *increment* or *divided increment* constituting the *partial sample* or the *gross sample* should be of almost uniform mass.

3.98 maximum reflectance: Highest value of *reflectance* obtained when any polished section of a particle or lump of *coal* is rotated in its own plane in linearly polarized light.

3.99 mean size: The weighted average *particle size* of any *sample*.

3.100 melting interval: The interval between the *hemisphere temperature* and the *flow temperature*.

3.101 microlithotype: Naturally occurring *maceral* or association of *macerals* with a minimum band width of 50 µm.

NOTES

33 Microlithotypes are classified in one of three categories, namely monomaceral, bimaceral and trimaceral microlithotypes, according to whether they contain significant proportions of *macerals* of one, two or three *maceral groups*. For the bimaceral and trimaceral microlithotypes, the proportion of an individual *maceral group* is more than 5 % by volume in each case.

34 The classification of the main *microlithotypes* in *bituminous coal* and *anthracite* and their *maceral group* compositions are given in table 3.

Table 3 — Classification of the main microlithotypes in bituminous coal and anthracite

Microlithotype	Maceral-group composition (Total ⩾ 95 % by volume, mineral-free basis)
Monomaceral	
Vitrite	Vitrinite
Liptite	Liptinite
Inertite	Inertinite
Bimaceral	
Clarite	Vitrinite + Liptinite
Durite	Inertinite + Liptinite
Vitrinertite	Vitrinite + Inertinite
Trimaceral	
Trimacerite	Vitrinite + Liptinite + Inertinite

3.102 Micum indices: The percentages of a specially prepared sample of *coke* remaining on a test sieve of 40 mm nominal size of openings (round hole) and passing a test sieve of 10 mm nominal

size of openings (round hole), denoted by M_{40} and M_{10} respectively, after the sample has been subjected to 100 revolutions by a specified procedure in a rotating drum.

NOTE 35 Other indices, e.g. M_{60}, M_{20}, may be reported if required.

3.103 milled coke: *Coke* reduced in size by grinding (milling) so that a high proportion will pass a fine sieve, for example a sieve of nominal size of openings 212 µm.

3.104 mineral matter: The inorganic material, excluding moisture but including *water of constitution*, in a solid mineral fuel.

NOTE 36 Mineral matter is calculated on a mass basis either from a direct determination at low temperature or from the *ash* yield at high temperature.

3.105 mineral sulfur: The sum of the *pyritic sulfur* and *sulfate sulfur* in a solid mineral fuel.

NOTE 37 For the purposes of this definition, elemental sulfur and monosulfides, which may be present in certain solid mineral fuels, are disregarded.

3.106 minerite: Collective term for intergrowths of minerals with different *macerals* where the proportion of the total *mineral matter* is more than 60 % by volume or if more than 20 % by volume of sulfide minerals are present.

3.107 moist, ash-free basis: A means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be ash-free but with a moisture content equal to the *moisture-holding capacity*.

3.108 moist, mineral-matter-free basis: A means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be mineral-matter-free but with a moisture content equal to the *moisture-holding capacity*.

3.109 moisture-holding capacity: The moisture content of a solid mineral fuel in equilibrium with an atmosphere of 96 % relative humidity at a temperature of 30 °C determined under specified conditions.

3.110 moisture in air-dried sample: The moisture in the solid mineral fuel sample after it has attained approximate equilibrium with the atmosphere to which it is exposed.

3.111 moisture in the general analysis sample: The moisture content of the *general analysis sample* of a solid mineral fuel after it has attained approximate equilibrium with the atmosphere in the laboratory and which is removable under specified conditions.

3.112 net calorific value at constant volume: The *gross calorific value at constant volume* less the latent heat of evaporation of the water originally contained in the fuel and that formed during its combustion.

NOTE 38 The net calorific value at constant volume is the negative value of the net specific energy of combustion.

3.113 nominal top size: The smallest sieve in the range included in the R 20 series (see ISO 565, square hole) on which not more than 5 % of the *sample* is retained.

NOTE 39 See also *top size; upper size* (3.191).

3.114 off-line sample preparation: *Sample preparation* performed manually or by mechanical equipment not integral with the mechanical sampling system.

3.115 on-line sample preparation: *Sample preparation* by mechanical equipment integral with the sampling system.

3.116 organic carbon; combustible carbon: The carbon in the organic matter of a solid mineral fuel.

3.117 organic coal substance: That part of a *coal* which contains all of the organically combined carbon, hydrogen, nitrogen, oxygen and sulfur.

3.118 organic hydrogen: The hydrogen in the organic matter of a solid mineral fuel.

3.119 organic sulfur: The sulfur which is bound in the organic matter of a solid mineral fuel.

3.120 outlier: A result which appears to be in disagreement with others from the same material and which arouses suspicion that there has been a mistake in the sampling, *sample preparation* or analysis.

3.121 oxidizing atmosphere: A gaseous medium consisting of oxygen, air, carbon dioxide, water vapour or a mixture of these, irrespective of the proportions used.

3.122 oxyreactivity: The rate of reaction of a solid mineral fuel with oxygen under specified conditions.

3.123 partial sample: A *sample* representative of a part of the whole *sampling unit*, constituted in order to prepare *laboratory samples* or *test samples*.

NOTE 40 A partial sample may be obtained by combining all *increments* from a *sampling unit* into two or more sets, each set being composed of consecutive *increments*, the number of which need not be the same in all sets.

3.124 particle size: The size of the sieve opening through which the particle will just pass. This may refer to sieves with round or square shaped holes; the shape of the holes shall be stated.

3.125 particle size reduction: The process of crushing or grinding the *sample* to reduce the *particle size*.

3.126 particulate block: Solid block consisting of particles of crushed *coal* representative of the *sample*, bound in resin, cast in a mould and with one face ground and polished.

3.127 pass (in sample division): The passage of an *increment* or a *sample* once through a sample divider.

3.128 petroleum coke: Solid agglomerated product consisting principally of carbon, obtained most often by thermal cracking of materials derived from petroleum.

3.129 porosity of coke: The ratio of the volume of the voids within a piece of *coke* to its apparent volume.

NOTE 41 It is the difference between the *true relative density* and the *apparent relative density* of a *sample* of *coke* expressed as a proportion of the *true relative density*.

3.130 post reaction strength: A measure of the residual strength of a *coke* after it has been subjected to a *reactivity* test.

3.131 precision: A measure of the extent to which observations within a set agree with each other.

NOTE 42 A determination may be made with great precision and the *standard deviation* of a number of determinations on the same *sampling unit* may therefore be low, but the results will be accurate only if they are free from *bias*.

3.132 primary increment: The *increment* taken at the first stage of sampling, prior to any *sample division* and/or *sample reduction*.

3.133 production seam profile sample: The *sample* taken from the section of the seam being worked.

3.134 proximate analysis: The analysis of a solid mineral fuel reported in terms of moisture, *volatile matter*, *ash* and *fixed carbon*.

3.135 pyritic sulfur: The sulfur present in the *mineral matter* of a solid mineral fuel as pyrite or marcasite.

3.136 random error: *Error* that has an equal probability of being positive or negative.

NOTE 43 The mean of the random errors resulting from a series of observations tends towards zero as the number of observations increases.

3.137 random reflectance: *Reflectance* of any polished section of a particle or a lump of coal when determined in unpolarized light without rotation of the specimen.

NOTE 44 The term *random reflectance* has replaced the terms *mean reflectance* and *average reflectance* to avoid any possible confusion arising from the meaning of the words "mean" and "average" in the mathematical sense.

3.138 range: The difference between the greatest and least values of a number of observations.

3.139 rank: Position of a *coal* in the coalification series indicating maturity in terms of chemical and physical properties.

NOTE 45 Higher rank coals are of greater maturity.

3.140 reactivity: The rate of reaction of a solid mineral fuel with a given agent under specified conditions.

NOTE 46 See also *carboxyreactivity* (3.24), *hydroreactivity* (3.80) and *oxyreactivity* (3.122).

3.141 reducing atmosphere: A gaseous medium consisting of methane, carbon monoxide, hydrogen or a mixture of these, irrespective of the proportions used.

3.142 reflectance: Percentage of the normal incident light reflected from a polished surface.

NOTE 47 In the context of petrography, reflectance refers to measurements made on *coal* under oil.

3.143 reflectance standard: Polished surface of a material of known *reflectance* which is used for calibrating reflectance measuring equipment.

NOTE 48 It is essential that the reflectance standard meets stringent requirements with regard to the properties of the material of which it is composed, and the way in which it is mounted and prepared.

3.144 relevant bias: *Bias* that is of practical importance, whether economic, scientific, legal or social.

3.145 repeatability: *Precision* under *repeatability conditions*.

3.146 repeatability conditions: Conditions where independent observed values or test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

3.147 repeatability critical difference: The value less than or equal to which the absolute difference between two final values, each representing a series of observed values or test results obtained under *repeatability conditions,* may be expected to be, with a specified probability.

NOTE 49 Examples of final values are the mean and the median of the series of observed values or test results; the series itself may consist of only one single observation.

3.148 repeatability limit: The value less than or equal to which the absolute difference between two single observed values or test results obtained under *repeatability conditions* may be expected to be, with a probability of 95 %.

NOTES

50 The symbol used is r.

51 The repeatability limit corresponds to the *repeatability critical difference* for two single observed values or test results and a probability of 95 %.

3.149 repeatability standard deviation: The *standard deviation* of observed values or test results obtained under *repeatability conditions*.

NOTES

52 It is a measure of the dispersion of the distribution of observed values or test results under *repeatability conditions*.

53 Similarly "repeatability variance" and "repeatability coefficient of variation" could be defined and used as measures of the dispersion of observed values or test results under *repeatability conditions*.

3.150 replicate sampling: The taking from the *sampling unit* of *increments* which are combined in rotation into different containers to give two or more *samples* of approximately equal mass, each being representative of the whole *sampling unit*.

NOTE 54 See also *duplicate sampling* (3.52).

3.151 reproducibility: *Precision* under *reproducibility conditions*.

3.152 reproducibility conditions: Conditions where observed values or test results are obtained with the same method on identical test material in different laboratories with different operators using different equipment.

3.153 reproducibility critical difference: The value less than or equal to which the absolute difference between two final values, each representing a series of observed values or test results obtained under *reproducibility conditions*, may be expected to be, with a specified probability.

NOTE 55 Examples of final values are the mean and the median of the series of observed values or test results; the series itself may consist of only one single observation.

3.154 reproducibility limit: The value less than or equal to which the absolute difference between two single observed values or test results obtained under *reproducibility conditions* may be expected to be, with a probability of 95 %.

NOTES

56 The symbol used is R.

57 The reproducibility limit corresponds to the *reproducibility critical difference* for two single observed values or test results and a probability of 95 %.

3.155 reproducibility standard deviation: The *standard deviation* of observed values or test results obtained under *reproducibility conditions*.

NOTES

58 It is a measure of the dispersion of the *distribution* of observed values or test results under *reproducibility conditions*.

59 Similarly "reproducibility variance" and "reproducibility coefficient of variation" could be defined and used as measures of the dispersion of observed values or test results under *reproducibility conditions*.

3.156 riffle: A non-mechanical divider in which the material is divided by means of alternate parallel slots, each of the same width, feeding into two opposite and separate containers.

3.157 Roga index: A measure of the caking power of a *coal* in terms of the mechanical strength of the *coke* obtained by carbonization, under specified conditions, of an intimate mixture of the coal and standard anthracite.

3.158 sample (noun): A portion taken from a *lot* or *sampling unit* to be representative of it with regard to the characteristic to be investigated.

3.159 sample (to) (verb): To take a portion of a material which is representative of the whole.

3.160 sample division: The process in *sample preparation* whereby the *sample* is divided into separate representative portions, one or more of which is retained.

3.161 sample preparation: The process of bringing *samples* to the condition required for analysis or testing.

NOTE 60 Sample preparation covers mixing, *sample division*, *particle size reduction* and sometimes air drying of the *sample* and may be performed in several stages.

3.162 sample reduction: The process in *sample preparation* whereby the *particle size* of the *sample* is reduced by crushing or grinding.

3.163 sampling frame: A parallel-sided frame used for taking a stopped-belt *increment* of a solid mineral fuel.

NOTE 61 The distance between the parallel sides of the frame should be not less than 2,5 times the *nominal top size* of the solid mineral fuel.

3.164 sampling unit: A quantity of a solid mineral fuel, the sampling of which results in one *gross sample*.

NOTE 62 There may be one or more sampling units per *lot*.

3.165 seam section: A *sample* of a coal seam taken from roof to floor, either as one representative mass or split into a number of subsections of different qualities.

3.166 segregation: The accidental separation of particles of different physical characteristics.

3.167 shale: A generic term for certain fine-grained sedimentary rocks, commonly occurring as an impurity in coal seams.

NOTE 63 This term should not be used as a general term for washery rejects.

3.168 shatter index: The percentage of a specially prepared sample of *coke* remaining on a test sieve of stated size of openings after the sample has been subjected to a specified dropping test.

3.169 sieving test machine: A machine designed to simulate the hand shaking procedure specified in the method for carrying out a *size analysis*.

3.170 silica ratio: The ratio of the mass of silica to the total mass of silica, iron(III) oxide, calcium oxide and magnesium oxide in *ash*, expressed as a percentage.

NOTE 64 This ratio gives an indication of the refractoriness of the *ash* and the tendency to form slag.

3.171 size analysis; sieve analysis (deprecated): The process or the result of the separation of a *sample* into *size fractions* with defined limits, the proportions of the fractions being expressed as percentages of the total sample.

3.172 size analysis sample: A *sample* taken specifically for particle *size analysis*.

3.173 sized coal; graded coal (deprecated): *Coal* which has been screened between two specified sizes.

3.174 size distribution; size consist (deprecated): The proportions of various *particle sizes* in a product.

3.175 size fraction: The part of the *sample* belonging to a specified *size range* limited by either one or two sieve sizes.

3.176 size range: The *top size (upper-size)* and the *bottom size (lower size)* of a solid mineral fuel.

3.177 slagging factor: A measure of the tendency of *ash* to form fused deposits in the radiant zone of a furnace.

3.178 small coal; smalls (deprecated): *Coal* with a specified *nominal top size* but with no lower size limit.

NOTE 65 The *nominal top size* is usually between 50 mm and 4 mm.

3.179 small coke: *Coke* with *nominal top size* of 20 mm or smaller.

3.180 standard deviation: The positive square root of the *variance*.

NOTE 66 This term is usually designated as *s*.

3.181 stratified random sampling: The taking of an *increment* at random within the mass interval or time interval determined for *mass basis sampling* or *time basis sampling* respectively.

3.182 struck levelling: A method of levelling the surface of a solid mineral fuel in a container when determining *bulk density*, whereby a straight edge is slid across the top of the container, any piece of solid mineral fuel which touches the straight edge being removed.

3.183 submaceral: Subdivision of a *maceral* based on slight morphological and physical differences.

3.184 sulfate sulfur: The sulfur present in the *mineral matter* of a solid mineral fuel as sulfate.

3.185 sulfur in ash: The sulfur which is present in the *ash* after a solid mineral fuel is burnt under specified controlled conditions.

3.186 systematic sampling: The taking of *increments* at equal intervals of time, space or mass over the whole *lot* or *sampling unit*, the first *increment* being taken at random within the first such interval.