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NATIONAL STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 483-2007

Replacing: GB/T 483-1998

General Rules for Analytical and Testing Methods of Coal

(ISO 1213-2:1992 Solid mineral fuels - Vocabulary - Part 2: Terms relating to sampling, testing and analysis, NEQ)

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Foreword

This Standard corresponds to BS 1016-100:1999 "Methods for Analysis and Testing of Coal and Coke - Part 100: General Introduction and Methods for Reporting Results" and ISO 1213-2:1992 "Solid Mineral Fuels - Vocabulary - Part 2: Terms Relating to Sampling, Testing and Analysis". The consistency degree of the standard and the above 2 standards is not equivalent. The main differences are as follows:

- The technical contents of this Standard only include "3 Definition and Symbol", "5 Result Report Basis" and "Result Expression" in BS 1016-100:1999. In addition, "Coal Sample", "Determination" and "Solution Concentration" are added.

- Some terms relevant to the coal analysis test in ISO 1213-2:1992 are adopted as part of Terms and Definitions in this Standard. According to ISO 1213-2:1992 “Hard Coal and Coke - Mechanical Sampling - Part 1: General Introduction", some terms and definitions in this Standard are modified.

This Standard replaces GB/T 483-1998 "General Rules for Analytical and Testing Methods of Coal".

Compared with GB/T 483-1998, The following modifications are made in this Standard:

- "Terms and Definitions" is added (Chapter 3 in this edition);

- “Method precision - the statistical calculation formula for the repeatability limit and reproducibility critical difference” is added (Chapter 5 in Edition-1998; Chapter 8 in this edition);

- The list of relevant standards is deleted in "Scope" (Chapter 1 in this edition).

This Standard was proposed by the China National Coal Association.

This Standard shall be under the jurisdiction of the National Technical Committee on Coal of Standardization Administration of China.

Drafting organization of this Standard: the Coal Analysis Laboratory of Coal Research Institute.

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GB/T 483-2007

Replacing GB/T 483-1998

General Rules for Analytical and Testing Methods of Coal

1 Scope

This Standard specifies the following contents relevant to coal analysis test: terms and definitions, symbols, analysis test of coal sample, solution concentration, determination, test result expression, result conversion, method precision and test record.

This Standard is applicable to various coal analysis test method standards, documents, books and periodicals, teaching materials and manuals.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For dated reference, subsequent amendments (excluding correction) or revisions of these publications do not apply. However, the parties who enter into agreement based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards. For undated references, the latest edition of the normative document referred to applies.

GB 474 Method for Preparation of Coal Sample

GB 475 Sampling for Commercial Coal

GB/T 6379.2 Accuracy (Trueness and Precision) of Measurement Methods and Results Part 2: Basic Method for the Determination of Repeatability and

Reproducibility of a Standard Measurement Method (GB/T 6379.2-2004, ISO 5725-2: 1994, IDT)

GB/T19494.1 Mechanical Sampling of Coal - Part 1: Method for Sampling (GB/T 19494.1-2004, ISO 13909-1:2001, ISO 13909-2:2001, ISO 13909-3:2001, NEQ)

GB/T 19494.2 Mechanical Sampling of Coal - Part 2: Method for Sample Preparation (GB/T 19494.2-2004, ISO 13909-4:2001, NEQ)

3 Terms and Definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1 Terms and Definitions for Coal Sampling and Sample Preparation

3.1.1 Coal sample

A portion of representative coal taken out of coal for determining some features of coal.

3.1.2 Seam-sample of coal

Coal sample taken from one seam in the excavating working face, exploring tunnel or gallery as required.

3.1.3 Stratified seam-sample of coal

Coal sample respectively taken from any natural layer of coal and dirt band as required.

3.1.4 Workable seam-sample of coal

All samples (including coal delamination and dirt band) to be taken according to the specified coal mining thickness

3.1.5 Coal sample for production

Coal sample representing the physical, chemical and technological characteristics of coal for production, extracted in the coal mining process of a whole shift under the regular production conditions.

3.1.6 Sample of commercial coal

Coal sample representing the average properties of commercial coal.

3.1.7 Float sample of coal

Coal sample floating in the upper part through the heavy-liquid (in certain density) concentration.

3.1.8 Sink sample of coal

Coal sample sinking in the lower part through the heavy-liquid (in certain density) concentration.

3.1.9 Test sample of coal

Coal sample prepared to meet requirements of some special test.

3.1.10 Common sample of coal

Coal sample taken for multiple tests.

3.1.11 Moisture sample of coal

Coal sample taken specifically for the determination of total moisture.

3.1.12 Air-dried sample of coal

Coal sample reaching air drying state.

3.1.13 General-analysis test sample of coal

Coal sample, crushed to the particle size less than 0.2mm, reaching the air drying state and used for the determination of most physical and chemical properties.

3.1.14 Size analysis sample of coal

Coal sample taken specifically for size analysis.

3.1.15 Laboratory sample of coal

Coal sample reduced from the gross sample or sub-sample and delivered to the laboratory for further preparation.

3.1.16 Certified reference-material of coal

Reference-materials of coal accompanied with certificates, of which one or more characteristic values are determined by the procedures with traceability established and may be traced to the accurate and reproductive measurement units capable of expressing the characteristic values, and each standard value is accompanied with the uncertainty of the given confidence level.

3.1.17 Sampling

A process of taking a representative portion from a great deal of coal.

3.1.18 Increment

A portion of sample taken by a sampler operating once or cutting the full cross section of the coal stream once.

3.1.19 Primary increment

Increment taken in the first stage of sampling and prior to any sample reduction and sample division.

3.1.20 Divided sample

A portion reserved after division to reduce the mass of test sample.

3.1.21 Gross sample

Coal sample of all the increments taken from a sampling unit.

3.1.22 Sub-sample

Coal sample composed of several primary increments distributed uniformly in the whole sampling unit.

3.1.23 Sampling unit

A quantity of coal, the sampling of which results in one gross sample, from a lot of coal which may be one or several sampling units.

3.1.24 Lot

An independent quantity of coal, the bulk property of which is to be determined.

3.1.25 Continuous sampling

Taking a gross sample from each sampling unit.

3.1.26 Intermittent sampling

Sampling from several sampling units.

3.1.27 Systematic sampling

Taking increments at equal intervals of time, space or mass with the first increment taken at random within the first interval and the rest increments taken at the selected intervals.

3.1.28 Random sampling

An increment sampling process where the sampling positions or time are not imposed with any wills, so as to take the coal from any position.

3.1.29 Stratified random sampling

Taking an increment randomly within mass or time interval divided in mass-basis sampling and time-basis sampling.

3.1.30 Mass-basis sampling

Taking increments from the coal flow or static coal with the position of each increment determined by a mass interval and the increment mass fixed.

3.1.31 Time-basis sampling

Taking increments from the coal flow with the position of each increment determined by a mass interval and the increment mass proportional to the coal flow.

3.1.32 Replicate sampling

Taking increments at certain intervals, and putting them into different vessels in turn to constitute two or more coal samples of approximate mass.

3.1.33 Duplicate sampling

Taking increments at a certain interval, and putting them into two different vessels alternately to constitute two coal samples of approximate mass.

3.1.34 Nominal top size

The corresponding aperture size of the sieve on which the accumulated sample mass fraction is most close to (not more than) 5%.

3.1.35 Sample preparation

Process to make the sample reaching the analysis or test state.

Note: Sample preparation including crushing, mixing and dividing and sometimes still including screening and airing may be divide into several stages.

3.1.36 On-line sample preparation

Sample preparation with the equipment integral with the sampling system.

3.1.37 Off-line sample preparation

Sample preparation conducted with the equipment not integral with the sampling system and performed manually or mechanically on the samples taken with the mechanical sampling system.

3.1.38 Sample division

The process in sample preparation whereby the sample is divided into separate representative portions.

3.1.39 Fixed mass division

Method of sample division with the retained sample mass predetermined, and independent of the mass of the divided sample.

3.1.40 Fixed ratio division

The method of sample division at a certain division ratio, namely the mass of the remained samples is proportional to the mass of the divided sample.

3.1.41 Cut

Increment taken by a primary sampler or sample divider.

3.1.42 Cutter

Equipment for cutting increment.

3.1.43 Riffle

3.3.7 Volume curve of plastic layer

Curve of upper layer positions of plastic mass along with temperature change recorded during the determination for plastometer indices of bituminous coal.

3.3.8 Final contraction value; plastometric shrinkage

Distance between end point and zero point lines of volume curve at a temperature of 730°C during the determination for plastometer indices of bituminous coal.

3.3.9 Roga index

The measure of the caking power of coal, proposed by Roga, in terms of the mechanical strength of the coke obtained by carbonization, under specified conditions, of an intimate mixture of the coal and the standard anthracite.

3.3.10 Caking index

The measure of the caking power of coal, proposed by China, in terms of the mechanical strength of the coke obtained by carbonization, under specified conditions, of an intimate mixture of the coal and the special anthracite.

3.3.11 Crucible swelling number

A measure for the expansibility and plasticity of coal, in terms of the dilatation serial number of the coke button obtained by heating in a crucible under specified conditions.

3.3.12 Audiberts-Arnu dilatation

A measure of expansibility and plasticity of coal, proposed by Audtherts and Arnu and expressed by such parameters as dilatation (b) and degree of shrinkage (a).

3.3.13 Gieseler fluidity

A measure of plasticity of bituminous coal, which is proposed by Gieseler and expressed by the maximum fluidity.

3.3.14 Initial softening temperature

One of Gieseler fluidity indices, the temperature with the rotate speed of stirring

paddle reaching 1.0 ddpm for the first time.

Note: ddpm is the abbreviation of dial division per minute.

3.3.15 Final fluid temperature

One of Gieseler fluidity indices, the temperature with the rotate speed of stirring paddle reaching 1.0 ddpm for the last time.

3.3.16 Solidification temperature

One of Gieseler fluidity indices, the temperature with the rotate speed of stirring paddle stopping.

3.3.17 Maximum fluidity

One of Gieseler fluidity indices, the fluidity with the rotate speed of stirring paddle at the maximum.

3.3.18 Maximum fluidity temperature

One of Gieseler fluidity indices, the temperature with the rotate speed of stirring paddle at the maximum.

3.3.19 Plastic range

One of Gieseler fluidity indices, the range from the initial softening temperature to the final fluid temperature.

3.3.20 Gray-King assay

The test method of lower-temperature carbonization of coal, proposed by Fisher and Schrader, to determine the yield of and coke type of pyrolysis products.

3.3.21 Shatter strength

A measure of crush resistance of coal, expressed by the mass fraction of the blocks greater than 25mm after the free fall of the coal sample in certain particle size to the original coal sample in size.

3.3.22 Thermal stability

A measure of the capacity of the heated coal to retain the designated size, expressed by the mass fraction mass fraction of particles greater than 6mm with

the coal sample of a certain particle size heated.

3.3.23 Carboxy reactivity

A measure of the capacity of reaction between coal and carbon dioxide, expressed by the mass fraction of carbon monoxide reduced by coal from carbon dioxide under specified conditions.

3.3.24 Clingkering property

A measure of slagging property with coal ash softened and melted where the coal ash is heated in the gasification and combustion of coal, expressed by the mass fraction of the slag lump(s) greater than 6mm to all the residues after the combustion of the coal sample in a certain particle size.

3.3.25 Grindability

Difficulty of coal to be ground into powder under specified conditions.

3.3.26 Hardgrov grindability index

A measure of difficulty of the coal being ground into powder, proposed by Hardgrove and expressed by the grindability coefficient corresponding to the volume of samples less than 0.071 mm in particle size after the coal of a certain particle size is ground by Hardgrove grindability tester under specified conditions.

3.3.27 Abrasion index

A measure of the abrasion of the coal grinding against metal pieces, expressed in milligrams of the specific metal piece abrasion per kilogram of coal under specified conditions.

3.3.28 Ash fusibility

Characteristic physical state (deformation, softening, hemisphere and flow) of the ash changing along with the heating temperature, obtained under specified conditions.

3.3.29 Deformation temperature

Temperature for the beginning of rounding or bending of the ash cone tip (or edge) in ash fusibility determination.

3.3.30 Softening temperature

Temperature for the ash cone bent to the conical tip and touching the supporting plate or for the ash cone to be spherical in ash fusibility determination.

3.3.31 Hemispherical temperature

Temperature with the ash cone shape becoming approximately hemisphere, namely with the ash cone height close to half of the bottom length in ash fusibility determination.

3.3.32 Flow temperature

Temperature with the ash cone melted to a lamella whose height is smaller than 1.5 mm in ash fusibility determination.

3.3.33 Ash viscosity

A measure of the resistance against the flow of ash in the fused state.

3.3.34 Base/acid ratio

The ratio of the mass of basic constituents (iron oxide, calcium oxide, magnesium oxide, manganese oxide) to that of acid constituents (silicon oxide, aluminium oxide and titanium oxide) in coal ash.

3.3.35 Fouling index; fouling factor

In general, it is the value obtained with the base/acid ratio multiplied by Na2O value in the coal ash.

3.3.36 Transmittance

The transmittance percentage of the solution obtained with the coal sample treated with the mixed solution of nitric acid and phosphoric acid under specified conditions.

Note: The index is applicable to brown coal and low coal rank bituminous coal.

3.3.37 Humic acid

A group of polybasic organic and amorphous compounds with high molecular mass in coal, which can dissolve in dilute caustic alkali and sodium pyrophosphate solution.

the basic unit shall be designated: it may be atom, molecule, ion, electronic and other particle(s) or a specific combination of these particles.

For example:

In $c(\frac{1}{5}KMnO_4)=0.1mol/L$, the basic unit to express the solute is $\frac{1}{5}$ molecule of potassium permanganate, the molar mass of which is 31.6g/mole, and the concentration is 0.1 mol per liter, namely a liter of solution contains 0.1x31.6g of potassium permanganate.

In $c(\frac{1}{2}Ca^{2+})=1mol/L$, the basic unit to express the solute is $\frac{1}{2}$ positive ion of calcium, the molar mass of which is 20.04 g/mole, and the concentration is 1 mol per liter, namely a liter of solution contains 20.04g of potassium permanganate.

5.2.2 Mass fraction or volume fraction

The ratio of the solute mass (or volume) to the solution mass (or volume), e.g. mass fraction 5%, volume fraction 5% and mass fraction 4.2×10^{-6}.

5.2.3 Mass concentration

The solute mass divided by solution volume, expressed by gram per liter or its multiple, fraction unit, e.g. g /L, mg/ml.

5.2.4 Volume ratio or mass ratio

Volume ratio or mass ratio between one reagent and another reagent (or water, expressed by (V_1+V_2) or (m_1+m_2), e.g. (1+4) sulfuric acid in volume ratio refers to the mixed sulfuric acid solution of 1-volume sulfuric acid in the relative density of 1.84 and 4-volume water.

6 Determination

6.1 Determination Times

Except special requirements, two times of determination (it is generally duplicate determination) shall be conducted on the same coal sample in the analysis test for each item. If the difference value of two determination values does not

exceed repeatability limit T, the arithmetic mean of the determination values shall be taken as the final result; or the third time of determination is required. If the extreme deviation of three determination values is less than or equal to 1.2T, the arithmetic mean of the three determination values shall be taken as the final result; or the fourth time of determination is required. If the extreme deviation of four determination values is less than or equal to 1.3 T, the arithmetic mean of the four determination values shall be taken as the determination result; if the extreme deviation is greater than 1.3 T but the extreme deviation of the three determination values is less than or equal to 1.2T, the arithmetic mean of the three determination values may be taken as the determination result. If all the above conditions are not met, determination results shall be abandoned, and the instrument and operation shall be inspected before determination is conducted again.

6.2 Moisture Determination Term

6.2.1 The total moisture shall be determined after the coal sample preparation; if the determination cannot be conducted immediately, the coal sample shall be weighed accurately and placed in the vessel required in Section 4.2 before the determination conducted as soon as possible.

6.2.2 As for the analysis test in need of correction or conversion according to the moisture determination result, the coal sample moisture shall be determined simultaneously; if the test and determination cannot be conducted simultaneously, they shall be conducted within as a short term as possible so that the coal sample moisture does not change significantly (within 5d at most).

7 Expression of Test Result

7.1 Symbol for Result Expression

7.1.1 Item symbol

As for the coal analysis tests, the first letters or the abbreviations of the English names for all the items of analysis tests are adopted, and the element symbols or molecular formula of all the chemical constituents are taken as their representative symbols. The special symbols for the items of coal analysis test and the corresponding English and Chinese names are listed as follows [Translator note: The Chinese names below are for reference only]:

a - maximum contraction, 最大收缩度;

SS - shatter strength, 落下强度;

ST - softening temperature, (灰熔融性)软化温度;

Tar - yield of tar, 焦油产率;

TRD - true relative density, 真相对密度;

TS - thermal stability, 热稳定性;

V - volatile matter, 挥发分;

Water - total water of distillation, 干馏总水 (产率);

x - final contraction of coke residue, 焦块最终收缩度;

y - maximum thickness of plastic layer, 胶质层最大厚度;

a - conversion ratio of carbon dioxide, 二氧化碳转化率.

7.1.2 Sub-item symbol

A further division of the item, expressed with the first letter or abbreviation of the corresponding English name adopted and marked at the lower right hand corner of the item symbol.

The sub-item symbols involved in coal analysis tests are as follows:

B - bomb, 弹筒;

F - free, 外在或游离;

Inh - inherent, 内在;

o - organic, 有机;

p - pyrite, 硫化铁;

s - sulfate, 硫酸盐;

gr, p - gross, at constant pressure, 恒压高位;

gr, v - gross, at constant volume, 恒容高位;

net, p - net, at constant pressure, 恒压低位;

f) Test personnel and examiner(s);

g) Other issues to be explained.

9.2 Test Report

The test report shall be filled according to the specified format, terms, symbols, and legal measurement units and shall include the following contents at least:

a) Name, serial number, sheet number and total sheet number of report

b) Name, address, post code, phone number and fax etc. of test organization;

c) Name, address, post code, phone number, fax and contact person etc. of entrusting organization;

d) Name, property and state, original number and submitting date of sample

e) Serial number of laboratory sample;

f) Items and based standard(s) or specification(s) of analysis test;

g) Result and conclusion (if applicable) of analysis test;

h) (If applicable) Sampling procedure (including coal product property, based standards for sampling, sampling basic number, number of sampling units and number of increments, increment mass and gross sample mass, sampling time, location and personnel);

i) (If applicable) Statement on that "this report is only responsible for the samples";

j) Authorizing officer(s), reviewer(s) and chief inspector(s) and issuing date

k) Other required information.

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