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Determination of apparent relative density of coal

煤的视相对密度测定方法

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Standardization Administration of the People's Republic of China.

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Determination of Apparent Relative Density of Coal

1 Scope

This Standard specifies the instruments and equipment, reagents, coal sample preparation, determination procedures, results calculation, and degree of precision for determination of apparent relative density of coal.

This Standard applies to lignite, bituminous coal and anthracite.

2 Normative references

The articles contained in the following documents have become part of this Standard when they are quoted herein. For the dated documents so quoted, all the modifications (excluding corrections) or revisions made thereafter shall not be applicable to this Standard. For the undated documents so quoted, the latest editions shall be applicable to this Standard.

GB 474 Method for preparation of coal sample (GB 474-2008, ISO 18283: 2006, Hard coal and coke - Manual sampling, MOD)

GB 475 Method for manual sampling of commercial coal (GB 475-2008, ISO 18283: 2006, Hard coal and coke - Manual sampling, MOD)

GB/T 482 Sampling of coal seams

GB/T 19494.1 Mechanical sampling of coal - Part 1: Method for sampling (GB/T 19491.1-2004, ISO 13909-1: 2001 Hard coal and coke - Mechanical sampling - Part 1: General introduction, ISO 13909-2: 2001, Hard coal and coke - Mechanical sampling - Part 2: Coal - Sampling from moving streams, ISO 13909-3: 2001, Hard coal and coke - Mechanical sampling - Part 3: Coal - Sampling from stationary lots, NEQ)

Specification of coal resources exploration and coal sampling 1989

3 Terms and definitions

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

3.1

Apparent relative density of coal

Ratio of coal mass to the mass of water with the same volume at 20°C.

4 Method summary

Weigh coal samples with a certain particle size; place into density bottle after the surface is coated and sealed with wax; use sodium dodecyl sulfate solution as the wetting agent; measure the volume of sodium dodecyl sulfate solution that has been discharged by the waxed coal particles; after subtracting the volume of wax, calculate the apparent relative density of coal at 20°C.

5 Reagents

5.1 Quality paraffin: Melting point (50~60)°C.

5.2 Sodium dodecyl sulfate solution ($C_{12}H_{25}NaSO_4$) solution: Use chemically pure sodium dodecyl sulfate solution to prepare 1 g/L solution. If the solution has been stored for a long time and has white precipitate, it shall be heated to dissolve and cooled to room temperature before use.

6 Instruments and equipment

6.1 Electric furnace: (500~600) W.

6.2 Analytical balance: Maximum weighing is 200 g, sensitivity is 0.000 1 g.

6.3 Density bottle: With ground capillary tube stopper, volume is 60 mL, shown in Figure 1.

the provisions of “Regulations on Collection of Coal Resources Exploration and Sampling”. Then crush to particles of which the size is less than 13 mm through step-by-step crushing method according to GB 474; separate one half of coal samples; use 10mm round-hole sieve (6.8) to screen out the coal sample with (13~10)mm particle size, and make it reach a air dry state. Put into coal sample bottle to serve as the coal sample for determination of apparent relative density.

8 Determination procedures

8.1 Pave the coal particles from coal sample bottle onto plastic cloth (6.9); use checkerboard method to take out (20~30)g of coal samples; for the coal of which the ash content is greater than 30% or total sulfur is greater than 2%, weigh (40~60)g; place onto 1 mm square-hole sieve (6.8); use hair brush to repeatedly brush away pulverized coal on coal particle surface; weigh the mass (m_1) of above-sieve substances, accurate to 0. 000 2 g.

8.2 Place the weighed coal particles on mesh spoon (6.6); immerse into molten paraffin wax (5.1) that has been pre-heated to (70~80)°C by small aluminum pan; maintain paraffin wax temperature at (60~80)°C; use glass rod to quickly scatter the coal particles, until there is no air bubbles. Take out the mesh spoon immediately; after cooling slightly, spread the coal particles onto glass plate (6.7); and use glass rod to scatter the coal particles quickly so that they do not stick to each other. Cool to room temperature. Weigh the mass of waxed coal particles (m_2), accurate to 0. 000 2 g.

8.3 Put the waxed coal particles into density bottle (6.3); add sodium dodecyl sulfate solution (5.2) to fill up to two thirds of density bottle. Plug the stopper; shake with hands or tap density bottles with fingers gently, until there is no air bubbles on surface of waxed coal particle; then add solution until it is about 1 cm away from bottle neck [Translator note: 1cm below the bottle neck]. Place density bottle in a thermostat (6.10); maintain a constant temperature at (20±0.5)°C for 1 h, or leave it at room temperature for over 3 h; and write down the solution temperature.

8.4 Use pipette to add solution to the bottle drop-by-drop; plug the bottle stopper carefully so that the excess solution can overflow from the upper end of capillary tube of bottle stopper. Ensue that there is no air bubble in bottle and in capillary tube.

8.5 Quickly wipe the density bottle to dry. Weigh immediately (m_3), accurate to 0. 0002 g.

8.6 Determination of blank value: Determine the blank value while measuring coal sample. Operate according to 8.3 and 8.4 (without adding coal sample). Weigh the mass (m_4) of density bottle and aqueous solution, accurate to 0. 0002 g. The difference of measured values of the same density bottle for two successive times must not exceed 0.0100g.

8.7 For coal sample of which the particle size is less than 10 mm, its apparent relative density may be calculated according to Annex A, but it shall be indicated in the report.

B.2.8 Aqueous ethanol solution: Prepare with 95% ethanol and water at a ratio of 1:1.

B.3 Determination procedures

B.3.1 Weigh the mass (m_a) of a density bottle of which the mass is constant (accurate to 0.000 2 g, hereafter the same).

B.3.2 Use pipette to add 1 mL of aqueous ethanol solution to density bottle along sidewalls of the bottle; pour in the distilled water that was newly boiled and cooled to about 20°C. Then maintain at a constant temperature for 30 min in thermostatic water bath. Water surface of thermostatic water bath shall be 10 mm lower than the density bottle-mouth.

Carefully plug the stopper in thermostatic water bath. Then excess water will overflow through the capillary tube of stopper. At this time, it shall be noted that air bubble shall not be existed in small hole. Use a small strip of filter paper to absorb the water in small hole of stopper until it levels to the mouth. Take out the density bottle; wipe the water on outer wall of density bottle; weigh its mass (m_b) immediately. This value shall be checked at least once a month.

B.3.3 Weigh 40g of paraffin wax and put into porcelain evaporating dish with a handle; Then put the evaporating dish into a drying oven at (102~105)°C; stir from time to time after paraffin wax melts; maintain the heat for 1 h; then stand for 30 min at this temperature.

B.3.4 Put melted paraffin wax into dried and pre-warmed air density bottle to a 2/3 height of the bottle. Then place in drying oven at (102~105)°C for 1 h, so as to cause the possible gaseous escape (the air may be removed by gently tapping or shaking the density bottle; thin glass rod may also be used to stir paraffin wax if necessary).

B.3.5 Cool down the density bottle that contains paraffin wax to room temperature; weight the mass (m_c). Then add 1 mL of aqueous ethanol solution along the sidewall of density bottle to fully fill the gap between paraffin wax and bottle. Use distilled water that was newly boiled and cooled down to bout 20°C TO fully fill up. Then put into thermostatic water bath at a constant temperature for 1 h.

B.3.6 In thermostatic water bath, plug the stopper carefully. After excess water overflows, there shall be no air bubble retained in the small hole. Use a small strip of filter paper to absorb water in the small hole until it levels to the mouth. After taking out the density bottle and wiping to dry carefully, weigh its mass (m_d) immediately.

B.4 Results calculation

B.4.1 Paraffin wax density is calculated according to Formula (B.1).

$$d_{Wax} = \frac{m_c - m_a}{(m_b + m_c) - (m_a + m_d)} \times 0.998\ 2 \qquad \cdots\cdots (B.1)$$

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