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**NATIONAL STANDARD OF THE  
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**Methods for chemical analysis of silica sand for foundry**

铸造用硅砂化学分析方法

**(English Translation)**

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### 1 Scope

This standard specifies the preparation and test methods of chemical analysis specimens of silica sand for foundry.

This standard applies to the analysis of silicon dioxide, aluminum oxide, iron oxide, titanium oxide, calcium oxide, magnesium oxide, potassium oxide, sodium oxide content, acid consumption value of natural silica sand, selected quartz sand, artificial quartz sand for foundry.

The parallel determination methods in this standard can be selected according to specific circumstances.

### 2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 601 Chemical reagent - Preparations of reference titration solutions

GB/T 603 Chemical reagent - Preparations of reagent solutions for use in test methods

GB/T 2684 Test methods for foundry sands and molding mixtures

GB/T 6682 Water for analytical laboratory use - Specification and test methods

GB/T 8170 Rules of rounding off for numerical values and expression and judgement of limiting values

### 3 Preparation of specimens

#### 3.1

The specimens must be representative and uniform, without any foreign impurities.

#### 3.2

The specimens for acid consumption value determination are selected from the specimens and carried out in accordance with the provisions of GB/T 2684.

#### 3.3

The specimens for determination of other indicators are reduced by quartering (if the particle size is too large, it shall be crushed to less than 0.8 mm first; the iron introduced during the crushing process shall be removed by a magnet before being reduced). Finally, about 20 g of specimen is obtained, which is ground until all of them pass through a 75  $\mu\text{m}$  sieve (i.e., a 200-mesh sieve). Place the above specimen in a weighing bottle; dry at 105 °C ~ 110 °C for 2 h; then put it in a dryer; cool it and set it aside.

### 4 Test method

Unless otherwise specified, the standard solutions, preparations, products used in the analysis are prepared in accordance with GB/T 601 and GB/T 603. Use reagents confirmed to be analytically pure and grade 3 water in accordance with GB/T 6682. The reagents used in the test, if the concentration is not specified, are the original concentration at the time of exit-factory.

The test results are determined according to the rounded value comparison method in GB/T 8170.

#### 4.1.1 Determination of silicon dioxide content by hydrochloric acid primary

dehydration weight-molybdenum blue absorptiometry

##### 4.1.1.1 Principle

The specimen is melted and decomposed with sodium carbonate; the sinter is dissolved with hydrochloric acid; the silicic acid is evaporated to dryness to dehydrate;

hydrochloric acid is added to dissolve soluble salts, filtered and burned into silicon dioxide, then treated with hydrofluoric acid to make silicon escape in the form of silicon tetrafluoride. The difference in mass before and after hydrofluoric acid treatment is the amount of silicon dioxide in the precipitate; the amount of residual silicon dioxide in the filtrate is determined by molybdenum blue absorptiometry. The sum of the two is the content of silicon dioxide in the specimen.

#### 4.1.1.2 Reagents and materials

- a) Anhydrous sodium carbonate;
- b) Hydrochloric acid;
- c) Hydrofluoric acid;
- d) Ethanol. 95%;

#### 4.1.1.4 Analysis steps

- a) Preparation of test solution.

Weigh 0.5 g of specimen (accurate to 0.0001 g); place in a platinum crucible; add

1.5 g of anhydrous sodium carbonate; mix with the specimen; add 0.5 g of anhydrous sodium carbonate to cover the surface; place in a high-temperature box-type resistance furnace; gradually heat from low temperature to 1000 °C ~

1050 °C; keep at this temperature for 15 min ~ 20 min; clamp the platinum crucible with crucible tongs with platinum heads; rotate carefully to make the molten material evenly adhere to the inner wall of the platinum crucible; cool it;

cover with a watch glass; add 20 mL of hydrochloric acid [4.1.1.2e)] to dissolve the molten block; place the platinum crucible in a water bath; heat until the carbonate is completely decomposed and no more bubbles are emitted; remove it;

wash the watch glass with hot water; remove the watch glass; then place the platinum crucible in a water bath to evaporate to dryness; place in an electric oven and dry at 130 °C for 1 h.

Cool it; add 5 mL of hydrochloric acid [4.1.1.2b)]; let it stand for 5 min; add about

20 mL of hot water; stir to dissolve the salts; add appropriate amount of filter paper pulp and stir; filter with medium-speed quantitative filter paper; collect the filtrate and washing liquid in a 250 mL volumetric flask; wash the platinum crucible wall and precipitate with hot hydrochloric acid [4.1.1.2 g)], until there is no iron ion (check with potassium thiocyanate solution); continue to wash with hot water, until there is no chloride ion (check with silver nitrate solution).

Move the precipitate and filter paper into the platinum crucible together; add 2 drops of sulfuric acid to the precipitate; dry it at low temperature on an electric furnace; then move it into a high-temperature furnace; gradually increase the temperature to fully ash the filter paper; finally burn it at 1150 °C ~ 1200 °C for

1 h; cool to room temperature in a dryer; weigh it; burn repeatedly until constant weight (the difference between two burning weighing is  $\leq 0.0002$  g, which is constant weight).

Wet the precipitate with water; add 3 drops of sulfuric acid and 5 mL ~ 7 mL of hydrofluoric acid; evaporate to dryness in a low-temperature furnace; repeat the process once; continue heating until all the sulfur trioxide smoke is gone; burn the crucible at 1150 °C ~ 1200 °C for 15 min; cool to room temperature in a desiccator;

weigh it; burn repeatedly until constant weight (the difference between two burning weighing is  $\leq 0.0002$  g, which is constant weight).

b) Determination of the specimen.

Dilute the above filtrate with water to the mark; shake well; pipette 25 mL into a

100 mL plastic cup; add 5 mL of potassium fluoride solution; shake well; let it stand for 10 min; add 5 mL of boric acid solution; add 1 drop of p-nitrophenol

For quartz sand specimens with a silicon dioxide content of more than 95%, after burning to constant weight, treat with nitric acid and hydrofluoric acid to make silicon escape in the form of silicon tetrafluoride; then burn to constant weight. The weight loss is the silicon dioxide content.

#### 4.1.2.2 Reagents and materials

a) Nitric acid;

b) Hydrofluoric acid.

#### 4.1.2.3 Instruments

a) Analytical balance. Accuracy 0.0001 g;

b) Platinum crucible. 30 mL ~ 100 mL;

c) High temperature box resistance furnace.

#### 4.1.2.4 Analysis steps

Weigh about 1 g of specimen, accurate to 0.0001 g; place in a platinum crucible with constant weight (the difference between two burning weighing is  $\leq 0.0002$  g); put in a high-temperature furnace; gradually heat from low temperature to 950 °C ~ 1000 °C;

keep warm for 1 h; take out and cool slightly; immediately put in a desiccator; cool to room temperature; weigh it. Repeat burning (15 min each time); weigh until constant weight (the difference between two burning weighing is  $\leq 0.0002$  g, which is constant weight).

Moisten the specimen after burning with a few drops of water; add 5 mL of nitric acid and 5 mL ~ 8 mL of hydrofluoric acid; cover the crucible with a small gap; heat for 30 minutes without boiling on a low-temperature electric furnace (the test solution shall be clear at this time); wash the crucible cover with a small amount of water; continue heating and