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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 13390-2008

Replacing GB/T 13390-1992

**Metallic powder-Determination of the specific surface area -
Method of nitrogen adsorption**

金属粉末比表面积的测定 氮吸附法

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1 Scope

GB/T 13390-2008 is the Chinese national standard on metallic powder-determination of the specific surface area - method of nitrogen adsorption, in the field of metallurgy. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 31 March 2008 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China; Standardization Administration of China, and has been in force since 1 September 2008. Classification: ICS 77.160, CCS H16. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This Standard specifies the method for determination of the specific surface area of metallic powder. This Standard applies to the determination of the specific surface area of metallic powder. The determination range is

0.1 m²/g~1000 m²/g. The determination of the specific surface area of non-metallic powder and microporous materials may also refer to it for use. The specific surface area determined in this Standard is the total specific surface area of the powder, including any open specific surface area where nitrogen molecules can enter the powder body. It is different from the

specific surface area measured by the air permeation method, which refers to the envelope surface area.

1.33 Pa~1.33x10-

2 Pa. The heating temperature is 100°C~300°C. The holding time is

0.5 h~3 h. When measuring with a continuous flow chromatograph, the specimen shall be heated and rinsed under a flowing inert atmosphere. The heating temperature is 100°C~300°C. The holding time is

0.5 h~3 h.

2 Normative references

The following documents contain provisions which, through reference in this Standard, constitute provisions of this Standard. For the dated references, their subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, the parties who enter into agreement based on this Standard are encouraged to investigate whether the latest editions of these documents are applicable. For undated reference documents, the latest editions apply to this Standard.

GB/T 5314 Powders for powder metallurgical purposes - Sampling

3.1 Terms

3.1.1 Adsorbate The adsorbed gas enriched on the surface of the adsorbent.

3.1.2 Adsorbent The powder that absorbs the measuring gas.

3.1.3 Equilibrium adsorption pressure The pressure of the gas when the adsorbate reaches equilibrium.

3.1.4 Saturation vapour pressure The vapour pressure when the adsorbate is completely liquefied at the adsorption temperature.

3.1.5 Relative pressure The ratio of equilibrium adsorption pressure to saturation vapour pressure.

3.1.6 Adsorption volume The volume of gas adsorbed by the adsorbent at equilibrium adsorption pressure.

3.1.7 Dead volume The volume of the area where the adsorbate fails to reach under equilibrium pressure.

3.2 Symbols The symbols used in this Standard are shown in Table 1.

5.3.3 Liquid nitrogen or liquid oxygen; it shall have a certain degree of purity so that its saturation vapour pressure remains stable during the measurement process.

6 Sampling

6.1 Sampling shall be carried out in accordance with the provisions of GB/T 5314.

6.2 If the volumetric method is used, the sample shall be weighed so that its total surface area is within the range of 5 m²~50 m². If a continuous flow chromatograph is used, the sample shall be weighed so that its total surface area is within the range of

0.5 m²~200 m².

7 Test procedure

7.1 Degassing Before the adsorption measurement, the specimen must be degassed. When measuring with a volumetric method tester, the specimen shall be heated and degassed under vacuum. The vacuum degree is

7.2 Measurement

7.2.1 Measurement by volumetric method Let a known amount of adsorbed gas gradually enter the sample chamber (see Figure 2). Each time the sample adsorbs gas, and therefore the gas pressure in the limited constant volume drops, until the adsorption reaches equilibrium. The amount of adsorbed gas is the difference BETWEEN the amount of gas entering the burette AND the amount of gas remaining in the burette and the sample holder after adsorption equilibrium. This amount is determined by the gas state equation. The dead volume must be determined before or after the adsorption isotherm measurement. This volume is calibrated with helium at the measured temperature.

7.2.2 Measurement by continuous flow chromatograph Nitrogen is the adsorbed gas. Helium is the carrier gas (hydrogen can also be used). After the two gases are mixed in a certain ratio, they flow through the sample at close to atmospheric pressure. Use a thermal conductivity cell to monitor the thermal conductivity of the mixed gas. Adjust the helium flow rate to about 40 mL/min; use the soap bubble flowmeter (14) to measure the helium flow rate R_{He}. Adjust the nitrogen flow rate. After the two gases are evenly mixed, use the soap bubble flowmeter (14) to measure the total flow rate R_T of the mixed gas. Then turn on the power; adjust the zero point of the bridge. After the apparatus is stable, put the Dewar flask filled with liquid nitrogen on the sample tube (12). When the adsorption reaches equilibrium, the thermal conductivity cell (9) detects an adsorption peak. Remove the liquid nitrogen bath; the thermal conductivity cell (9) again detects a desorption peak with the opposite polarity to the adsorption peak. Usually, after the helium flow is adjusted, it will not be re-adjusted. By changing the nitrogen flow rate, change the relative pressure. Within the range of relative pressure P/P₀ of 0.05~0.30, at least 3~5 points must be measured. After the desorption is completed, turn the six-way valve (10) to the calibration position; inject a known volume of pure nitrogen into the mixed gas, to obtain a standard peak. For

instruments with instrument constants, there is no need measuring standard peaks.

8.1 Volumetric method

8.1.1 Dead volume correction factor The dead volume correction factor ϕ is calculated by formula (7).

8.1.2 Amount of adsorbed gas filled The amount of adsorbed gas filled is calculated by formula (8).