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

GB/T 21650.2-2008

**Pore size distribution and porosity of solid materials by
mercury porosimetry and gas adsorption -- Part 2: Analysis of
mesopores and macropores by gas adsorption**

压汞法和气体吸附法测定固体材料孔径分布和孔隙度 第2部分：气体吸附法分析
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(English Translation)

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Foreword

GB/T 21650 "Determination of mercury porosimetry and gas adsorption solid materials the pore size distribution and porosity" is divided into the following three parts.

--- Part 1. Mercury;

--- Part 2. Gas adsorption analysis mesopores and macropores;

--- Part 3. Analysis of micropores by gas adsorption.

This is Part 2 GB/T 21650 of.

This part identical with ISO 15901-2:2006 "Determination solid materials the pore size distribution and porosity of the second mercury porosimetry and gas adsorption Part. Gas adsorption analysis of mesoporous and macroporous "(in English).

For ease of use, and ISO 15901-2. Compared to 2006, the editorial changes made the

following section.

- The "this International Standard" by "this section";
- The "this part of ISO 15901" to "this section" will "77.35K" all changes for the "77K";
- With GB/T 19587-2004 instead of ISO 9277:1995, and modify the corresponding figure number;
- An increase of 3.13 "adsorbed molecules can reach the" statements;
- Remove the communication and information in Europe and America standard reference material supply mechanism;
- Part of the provisions made editorial adjustments;
- Some spelling mistakes, errors in the formula errors made editorial changes;
- Readjust the number of references and formats;
- Revised Figure 1, Figure 2 and Figure 3 illustrate the position of the axis text, extending the desorption branch in Figure 2 H2 type curve;
- Be modified to subscript he said complements Appendix A dimensionless quantity unit "/" in Appendix A variable expression units.

Appendix A of this section is an informative annex.

This part of the National and sorting method Standardization Technical Committee particles sieved (SAC/TC168) and focal points.

This section drafted by. Institute of Process Engineering, Beijing Physical and Chemical Analysis Center.

Introduction

Typically, different types of holes may be regarded as holes, channels or cavities in the solid, or the formation of the bed, solid granules or pressed aggregates Space between (such as cracks or voids). Often used to represent the porous nature of the porosity of solid materials, which more accurately defined as. A certain amount of solid Body measurement holes and voids volume can be compared with some of the total volume occupied by the solid. In addition to measuring hole, but there may be some solid Obturator, these holes is not connected with the outer surface, and the fluid can not penetrate. This section does not involve the obturator (ie, not communicating with the outer surface of the cavity) of Characterization.

The porous material may be a fine or coarse powder accumulation body, extrudates, flakes or monolithic body and the like. They usually include characterization measurement hole Size distribution and total pore volume or porosity. In order to meet certain requirements,

sometimes we need to study the shape of the hole and connectivity, as well as internal and surface area measurement External surface area.

The porous material of great technical importance in the following areas.

- Controlled drug release;
- catalytic;
- Gas separation;
- Including sterilization, including filtration;
- Materials Technology;
- Environmental protection and pollution control;
- Natural accumulator rocks;
- Materials properties;
- Polymers and ceramics industries.

It is well known properties (such as strength, reactivity, permeability or absorption capacity) by the pore structure of the porous solid decision, there are several ways to use to characterize the pore structure. Since most of the complex structure of the porous solid thus obtained results of different methods can not generally coincide, and one kind alone the method can not give all the information pore structure. Applications should be based on a porous solid material, its chemical and physical properties and pore size range selection Characterization methods most appropriate.

The most common method is as follows.

- a) the mercury method. pressing the mercury filling hole. This method is suitable for the pore diameter range of between about 0.003 μ m to 400 μ m, especially Most materials between 0.1 μ m to 100 μ m.
 - b) gas adsorption analysis mesoporous - macroporous method. characterized by a gas adsorption pore structure, such as nitrogen, liquid nitrogen temperatures. The appropriate method Measuring pore size range of about hole (of 2.0nm to 100nm) between 0.002 μ m to 0.1 μ m, which is the surface area Develop evaluation techniques (see GB/T 19587-2004) of. (Other pore size distribution analysis techniques can be found in reference [1])
 - c) gas adsorption micropore analysis method. characterized by a gas adsorption pore structure, such as nitrogen, liquid nitrogen temperature. This method is suitable for measuring Aperture range of about hole (0.4nm to 2.0nm) between 0.0004 μ m to 0.002 μ m.
- GB/T 21650.2-2008/ISO 15901-2:2006 of solid materials by mercury porosimetry pore size and gas adsorption Distribution and porosity Part 2. Gas adsorption Analysis of mesopores and macropores

1 Scope

This section GB/T 21650 provides a method of the porosity and pore size distribution was determined by gas adsorption method, for comparative Rather than test the absolute sense. This method is limited at a constant temperature control, the adsorption amount measurement unit mass of the sample gas.

This section does not require the use of specific adsorption of gas, but nitrogen gas adsorption is the most commonly used, while the temperature of liquid nitrogen is the most commonly used sub Analysis of temperature. Sometimes other adsorbed gases, including argon, krypton, and carbon dioxide. Also use other analytical temperature, including solid and liquid argon Body temperature of carbon dioxide. When using the nitrogen adsorption at liquid nitrogen temperature, the basic approach of this method is the determination of nitrogen adsorption at 77K with the amount of changes in the relative pressure.

This section provides a large pore size distribution calculation method 2nm ~ mesoporous pore size and pore size distribution of 50nm 100nm reached. general , The nitrogen adsorption is most suitable for measuring a width of about 0.4nm pores within the range of ~ 50nm in. Since the temperature control and pressure measurement technology Advances in surgery, can now be used to determine a larger pore width.

The method in this section is applicable for a wide range of porous material. Even if the pore structure of certain materials may be affected by pretreatment or cold it has affected system.

This section provides two types of measurement method of gas adsorption amount.

--- Measure to reduce the amount of gas from the gas phase (ie gas volume method);

--- Measuring the amount of gas adsorbent obtained (ie, direct measurement of the mass increase the weight of the law).

The actual application, you can use static or dynamic techniques to determine the amount of gas adsorption. In order to calculate the basis isotherm pore volume and pore size Cloth, requires using one or more mathematical models, which requires substantially simplifying assumptions.

2 Normative references

The following standards contain provisions which through reference GB/T 21650.2 of the present, constitute provisions of this section. For dated references Documents, all subsequent amendments (not including errata content) or revisions do not apply to this section. However, according to the encouragement of part Research into whether the parties to the agreement to use the latest versions of these documents. For undated reference documents, the latest versions apply to this section.