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**Vacuum technology - Vacuum gauges - Procedures to measure
and report outgassing rates**

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foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for Standardization Work Part 1: Structure and Drafting Rules for Standardization Documents"

drafting:

This document is equivalent to ISO /T S20177:2018 "Testing and reporting procedure for vacuum technology vacuum gauge outgassing rate":

Please note that some contents of this document may refer to patents: The issuing agency of this document assumes no responsibility for identifying patents:

Introduction

Bleeding of the vacuum chamber wall and its internal components limits the ultimate pressure of the vacuum system and its cleanliness: For research equipment (such as accelerated

equipment), equipment that needs to ensure surface cleanliness (such as molecular beam epitaxy equipment), or equipment that needs to maintain high vacuum under long-term pump-free conditions (such as equipment containing hair

For equipment such as injectors or X-ray tubes, medical instruments, surface analysis instruments or thermal insulation panels, etc:), the achievable ultimate pressure is an important

technical indicators: In many industrial applications, such as coating, extreme ultraviolet lithography, catalysis, drying processes in the pharmaceutical or food industry, and accelerated

For reactors, fusion reactors, etc:, vacuum cleanliness (that is, complete absence of a particular gas or vapor, or their partial pressure is sufficiently low) is also an important

required technical indicators: Therefore, in vacuum technology, the test of outgassing rate is

an important quality assurance measure: This document specifies the

The test procedure of outgassing rate makes the measurement results of outgassing rate traceable:

Appendix A lists schematics of various test systems:

Vacuum Technology Vacuum Gauge

Outgassing Rate Testing and Reporting Procedures

1 Scope

This document specifies the outgassing rate test procedure for vacuum chambers as a whole and its components: The outgassing rates applicable in this document are determined by

Produced by high vacuum equipment, less than $1 \times 10^{-5} \text{ Pa} \cdot \text{m}^3 \cdot \text{s}^{-1}$ ($1 \times 10^{-2} \text{ Pa} \cdot \text{L} \cdot \text{s}^{-1}$) at 23°C , various gases generated by degassing

Or the molecular weight of the steam is less than 300u:

The upper limit of the total outgassing rate, $1 \times 10^{-5} \text{ Pa} \cdot \text{m}^3 \cdot \text{s}^{-1}$, has nothing to do with the size, total surface area, material or state of the outgassing material: If marked

It is said that the outgassing rate (outgassing rate per unit area) has been determined, and the area shall be the nominal geometric surface area instead of the specific surface area including surface roughness:

When it is difficult to determine the nominal geometric surface area of the sample (such as powder, porous material, very rough surface or complex equipment, etc:), the single

Bit mass outgassing rate (eg outgassing rate per gram):

In many practical applications, it is only necessary to determine the total outgassing rate: If a test instrument whose sensitivity depends on the type of gas is used, the total outgassing

Rates are given as equivalent nitrogen outgassing rates: If the total outgassing rate is high, there are species that need to identify interfering gases in order to improve the sample material:

class and determine its outgassing rate: This document covers both cases:

Some molecules produced by outgassing were able to be adsorbed by the surface and the residence time was much longer than the total test time: These molecules are not on the direct path

, it cannot be detected by the test equipment: This can be considered a surface effect, and studies using surface analysis are far more effective than the conventional outgassing considered here:

Rate measurement is more effective: At the same time, molecules released from surfaces by ultraviolet light or X-ray irradiation are also not applicable to this document:

This document is formulated to standardize the test method of outgassing rate, so that the test values obtained in different laboratories and using different methods

comparable: For this purpose, for any of the methods specified in this document, the most important parameters in each method can be traced to

International Base Units (SI):

The mass loss method is a gas-independent test method for outgassing rate, which is mainly used for testing the outgassing rate of spacecraft and satellite materials:

Within the acceptable test time range, the outgassing rate ($>1 \times 10^{-5} \text{Pa} \cdot \text{m}^3 \cdot \text{s}^{-1}$) that can be tested by the mass loss method is significantly higher than that of the conventional high-fidelity method:

Outgassing rates for empty and ultra-high vacuum components: Moreover, since the balance is not suitable for use in a vacuum environment, considering the weight of the vacuum chamber, it is impossible to

bit test samples: Therefore, this document does not consider the mass loss method:

This document is suitable for those who are familiar with high vacuum and ultra-high vacuum technology and corresponding test instruments (for example, ionization vacuum gauge and quadrupole mass spectrometer

etc.) personnel used:

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text: Among them, dated references

For documents, only the version corresponding to the date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to

this document:

ISO 3529 (all parts) Vacuum technology terminology (Vacuumtechnology-Vocabulary)

Note: GB/T 3163-2007 Vacuum Technical Terms (ISO 3529:1981, MOD)

ISO 14291 Definitions and specifications for vacuum gauge quadrupole mass spectrometers

Note: GB/T 40333-2021 Definition and specification of vacuum gauge quadrupole mass spectrometer (ISO 14291:2012, IDT)

ISO /IEC 17025 General requirements for the competence of testing and calibration laboratories

Note: GB/T 27025-2019 General requirements for the competence of testing and calibration laboratories (ISO /IEC 17025:2017, IDT)

ISO /T S20175 Vacuum technology Vacuum gauges - Characteristics of quadrupole mass spectrometers for partial pressure measurements

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