

Principle of Vacuum Generator in Spectrometer



Article Overview

A vacuum generator in a spectrometer creates a low-pressure environment to minimize ion collisions, using a combination of mechanical and high-vacuum pumps to achieve pressures as low as 10^{-5} Pa.

Purpose of Vacuum in Spectrometry

In mass spectrometers, a high vacuum is essential to reduce collisions between ions and gas molecules, which can cause scattering, neutralization, or fragmentation, all of which interfere with accurate mass analysis. Typical operating pressures range from 10^{-2} to 10^{-5} Pa depending on the instrument design and ionization method .

Vacuum Generation Mechanism

Vacuum generation in spectrometers generally involves two or more pumping stages:

- **Rough Vacuum Stage:** A mechanical pump (rotary vane or diaphragm pump) reduces the chamber pressure to around 0.1 Pa. This stage removes the bulk of the air and prepares the system for high-vacuum pumping .
- **High-Vacuum Stage:** Turbomolecular pumps or diffusion pumps further reduce the pressure to the operating range (10^{-3} to 10^{-5} Pa). Turbomolecular pumps work by rapidly rotating blades that impart momentum to gas molecules, directing them out of the chamber . Some advanced instruments, such as Fourier Transform Ion Cyclotron Resonance (FT-ICR) spectrometers, may include a cryogenic pump as a third stage to achieve ultra-high vacuum conditions

Article Content

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Vacuum Generator Working Principle

The vacuum generator based on Bernoulli principle can safely separate thin and porous workpiece. Coanda principle Use integrated

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Quadrupole Mass Spectrometers (QMS)

Delve into the operating principle and design of Quadrupole Mass Spectrometers. Learn about their application in vacuum systems

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5.1: Vacuum System

All mass spectrometers operate at very low pressure (high vacuum). This reduces the chance of ions colliding with other molecules

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CHAPTER 3: An Introduction to Vacuum Systems

In Chapter 1, we learned that vacuum technology is used to intentionally create a volume with a lower

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Vacuum tube

A vacuum tube, electron tube, thermionic valve (British usage), or tube (North America) is a

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Vacuum System

A turbomolecular pump is a clean vacuum pump suitable as the main pump of a mass spectrometer. The

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Vacuum Technology: Know-How | Pfeiffer Global

Explore the fundamentals of vacuum technology and its applications. Learn about vacuum generation, leak detection, contamination

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Else_COAC-V052_1 1..46

3. VACUUM SYSTEMS In the mass analyzer it is undesirable to have the gas phase analyte ions either deviate from their desired

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Vacuum Technology for Mass Spectrometry Instruments

Beginning with the simple question "Why do we need vacuum" we will move on to discuss the types of vacuum technology typically

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Principles of Vacuum

RGAs are chemical analyzers, most often based on a compact quadrupole mass spectrometer, that can be

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Vacuum generator spectrometer

In a laboratory-based photoelectron spectrometer, a radiation source generates photons that bombard the sample, ejecting

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Creating a Vacuum

Mechanical Compression-Expansion Vacuum Pumps Mechanical pumps that operate on the compression-expansion principle are by

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Vacuum Systems in Mass Spectrometry: Enhancing Analytical

Fundamentals of vacuum systems in mass spectrometry The primary function of a vacuum system in mass spectrometry is to create

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Overview of Vacuum System : Shimadzu Scientific Instruments

A vacuum system is indispensable to the free flight of ions in a mass analyzer. Two stages of a vacuum pumping system are

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Detailed analysis of the working principle of vacuum generator

Many vacuum generators are based on the Venturi principle. Compressed air is fed into the vacuum generator (A), and

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Fundamentals of Vacuum | Power & Motion Tech

Knowing how to measure vacuum level and select the right pump technology are some of the basic steps required to design an

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Operating principles of vacuum generation

Operating principle Pneumatic vacuum generators function based on the Venturi principle Compressed air is introduced into the

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Overview of Vacuum Generator Working Principles

Vacuum generators are a convenient and efficient way to create a vacuum in order to get a desired result. In conclusion, the vacuum

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Vacuum generators | How do they work & Selection guide | Tameson

More on suction cups in another video! Vacuum generators operate on the Venturi effect

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Understanding the Need for Vacuum in Mass Spectrometry

In this article, we will explore why a mass spectrometer requires a vacuum, explaining its significance and function. The

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VacuumRev07

VACUUM TECHNIQUES A good vacuum is essential to many experimental physics applications especially those at the physical

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The physics and technology of quadrupole mass spectrometers

The fundamental principles of quadrupole mass spectrometers (QMS) are discussed, concentrating on instruments

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Working principle of vacuum generator

A vacuum generator is a device used to generate and maintain a vacuum environment, and

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The physics and technology of quadrupole mass spectrometers

Keywords: Mass spectrometer Physics Quadrupole QMS Residual gas analysis (RGA) Partial pressure analysis (PPA) The

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SEM Principle | West Campus Materials Characterization Core

SEM Principle The SEM is composed of several primary operational systems: Vacuum A vacuum, typically 10^{-5} - 10^{-11} Torr, is

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Fundamentals of Vacuum Technology

Pressure p can be more closely defined by way of subscripts: Absolute pressure is always specified in vacuum technology so that

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Vacuum mass spectrometry

Vacuum mass spectrometry C Greaves, BSc, PhD, AInstP, Lanchester Polytechnic, Eastlands, Rugby, Warwickshire

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The Science Behind Vacuum Generators: How They Work and Their ...

The Principles of Vacuum Generation At the core of any vacuum generator is the principle of creating a vacuum,

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Operating principles of vacuum generation

The dynamic pressure increases, while the static air pressure simultaneously decreases. The compressed air escapes from the

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