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A new calibration method and apparatus of vacuum mass spectrometer

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Abstract

The vacuum mass spectrometer is a kind of vacuum gauge for partial pressure measurement. For many vacuum applications, the partial pressure for given gas is of more interest than the total pressure of the gases in a system. If precise measurement of the partial pressure is needed, the calibration of mass spectrometer is necessary. However, the sensitivity for one gas in a mixture was changed as other gas pressure was varied. Therefore, for a specific measurement object, the specific standard sample mixture must be used to calibrate mass spectrometers. A new calibration method of vacuum mass spectrometer from 10^{-9} Pa to 10^{-5} Pa for He, N₂, Ar, O₂, Ne has been put forward. The experimental apparatus has been set up. The calibration apparatus is composed of pumping system, gas supply system, standard sample system, inlet system and calibration system. The gas flow between the inlet orifice and pumping orifice realized molecular flow in low pressure region. Two orifices were designed to be molecular flow conductance for mixture gases passing through them, which makes the gases proportion in the calibration chamber similar to that in the inlet chamber and in the standard sample chamber. Under the condition of molecular flow, the gases proportion was kept constant and sensitivities for different gas species were almost kept constant. With increasing the pressure of inlet chamber, the gas flow will deviated from the molecular flow region and sensitivities changed largely from one gas to another. The sensitivity calibrated with single gas was different from that calibrated with mixed gas.

Keywords: calibration, vacuum mass spectrometer, molecular flow, standard sample gas mixture

Topic of the contribution : vacuum calibration

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