SRG Technology Note

The **Spinning Rotor Gauge (SRG)** is based on the effect that gas molecules slow down a moving body when they are adsorbed and then desorbed on its surface. By measuring the deceleration rate of the moving body, the gas pressure can be determined. SRGs use three components to measure vacuum pressure:

1) A magnetic steel sphere, acting as the sensor body, is placed inside a thimble that is connected to the vacuum system (image 1).
2) A measuring head (image 2) mounted on to the senor thimble, which uses electromagnetic fields to levitate, accelerate and measure the sensor sphere.
3) An electronics controller unit (image 2) is connected to the measuring head.

Image 1: Sensor thimble connected to vacuum system with a sensor sphere inside.

Image 2: A VIM-2 system as an SRG example: 1) sensor sphere + thimble. 2) measuring head. 3) electronics unit.

Two main components contribute to the deceleration rate of the sensor sphere:

1) The molecular drag:
It is the deceleration caused by the surrounding gas medium, which is proportional to the pressure. Gas properties such as temperature and molar mass influence the pressure readings as a root factor, but they are easily accounted for. The molar mass is a well-known property and temperature is monitored by a temperature sensor inside the measuring head.

2) The residual drag:
A deceleration component caused by physical properties of the sensor sphere inside the magnetic levitation field. It is pressure independent and can be seen as an offset similar to Pirani or capacitance gauges. It is relevant for pressures $<10^{-5}$ mbar but can be roughly pre-determined and stored or set with a zero-procedure.

Sensor calibration

The physical surface properties of an SRG sensor sphere affect the pressure readings, which is corrected by a calibration factor. An ideal smooth sensor sphere has a calibration factor of 1, while real sensor spheres show a max. ± 6 % deviation of unity. For most applications, a recalibration is not necessary since long-term stability of the calibration factor is well documented. When calibrated and zeroed, SRGs can achieve an accuracy of 1% of reading.

Even without offset and calibration, SRGs posses a unique intrinsic accuracy in high vacuum, which is often times more than sufficient for many applications.

Measurement range

General measuring range - 10 mbar to 5×10^{-7} mbar.
1% accuracy of reading can be achieved between 0.1 and 1×10^{-6} mbar, with a typical drift of <1.5% per year.

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