Squeeze-film pressure sensor

Sensor for measuring two properties of a gas

Reference no. P 173

BACKGROUND

Pressure sensors are used in various technical sectors, such as in cryogenic or ultra-high vacuum environments, in chip manufacture, and in vehicle hydrogen storage tank monitoring. The gas temperature and gas pressure must be kept within certain limits in conventional methods. For very low gas pressures, such as in ultra-high vacuums or in the case of cryogenic gases, it is only possible to measure the gas pressure indirectly. Commercially available pressure measuring devices output a total pressure value for a gas or gas mixture. However, information about the type of gas or, in the case of a gas mixture, the partial pressures cannot be gathered with existing pressure measuring devices.

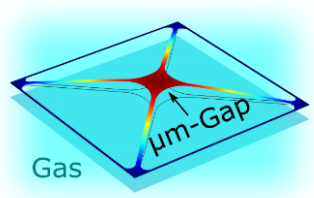
SOLUTION

The novel pressure sensor is based on an innovative chip technology (see Figure 1), making it scalable and versatile – adaptable to a wide range of pressures and molecules, all without the need for elaborate calibration. There is also simultaneous measurement of the quality factor and the resonance frequency of the gas pressure with known analytical relations to the pressure of the gas and the mass of its particles.

ADVANTAGES

- Compact sensor with variable positioning, making local pressure measurement possible
- Suitable for wide temperature ranges (-269°C to > 300°C), pressure ranges from UHV to > 1013 mbar (more than 10 orders of magnitude) with a single sensor
- No calibration required (based on "first principles") Compatible with strong magnetic fields thanks to optical readouts and use of non-magnetic materials. Electronic readout

Chip-based gas pressure sensor



Oscillating membrane shuttles gas in and out of gap → Q factor & freq. depend on gas pressure

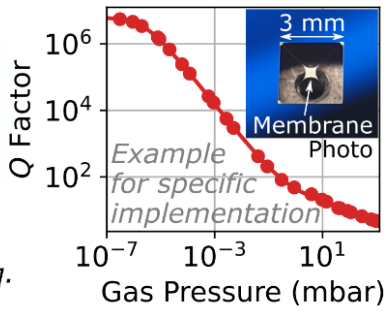


Fig. 1: (left) Operating principle of the squeeze-film pressure sensor. (right) Pressure dependence of the quality factor and photograph of the sensor membrane (silicon nitride)

POTENTIAL APPLICATION AREAS

Monitoring for

- Hydrogen tanks in vehicles
- Leakage detection in SLH 2 or CcH 2 storage tanks
- Precise UHV measurements
- Measurements over wide pressure ranges (from UHV to overpressure) with a single sensor
- Local pressure measurement
- Pressure measurement in strong magnetic fields

PROPERTY RIGHTS

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POSSIBILITIES FOR COLLABORATION

- Licensing
- R&D cooperation

CONTACT

Lan Fimmen
DESY Innovation and Technology Transfer
E-mail: lan.fimmen@desy.de
Tel. +49 (0)40 8998 1748
innovation.desy.de