VA 4: New Vacuum Gauges - Development and Characterization

Time: Monday 14:00–15:25 Location: H6

Invited Talk VA 4.1 Mon 14:00 H6

Development of a new wireless SAW-Pirani vacuum sensor with extended range and sensitivity — •Sofia Toto and Juergen Brandner — Karlsruhe Institute of Technology

Vacuum sensors with a broad range are required for a number of applications. Many types of vacuum sensors already exist relying on various operating principles. One of their biggest drawback is their limited sensing range. In light of the recent technology and of the industry requirements, a new sensor aiming to sense a broader vacuum range extending from atmospheric pressure down to high vacuum has been developed. It uses state of the art microelectronics enabling efficient wireless power and signal transfer, resistant and stable materials that prevent outgassing and micromachining that allows a compact stable packaging in vacuum.

The sensor operates based on the Pirani principle and Surface Acoustic Waves (SAW-Pirani principle). A piezoelectric chip located inside a channel inserted in a vacuum environment is heated. The heat loss of the chip to its ambient through gas conduction is proportional to the number of molecules in the vacuum system. Temperature variations of the chip due to pressure changes in the vacuum chamber are detected by the change in frequency values of a crossing surface acoustic wave propagating on the surface of the chip via an interdigitated transducer. An interrogation signal is sent to the Interdigitated Transducer (IDT) and the frequency shift due to the pressure is recorded by the reflected signal. The vacuum pressure can therefore be calculated from the temperature of the heated body.

VA 4.2 Mon 14:40 H6

Combined total - partial pressure sensor — •Mihail Granovskij, Sergej Uchatsch, Klaus Bergner, Michael Flämmich, and Ute Berger — VACOM Vakuum Komponenten und Messtechnik GmbH, In den Brückenäckern 3, 07751 Großlöbichau

The recent progress in the development of a vacuum gauge with an integrated He-leak detector based on a novel ion source will be presented.

The fundamental idea of the vacuum gauge is the novel measuring principle: Instead of directly measuring the ion current, ions are accumulated inside an electron space charge region. The total pressure in the chamber is determined by the accumulation time that is necessary to collect a certain amount of ions. Thereby the capacity of the ion trap is independent from the prevailing pressure and is exclusively determined by the space charge density.

Furthermore, a short time-of-flight (TOF) path is connected to the ion source. On this route, the collected ions are separated according to their masses and measured at the Faraday Cup detector in a time separated manner. This enables the gauge to measure the residual gas composition. In particular a Helium leakage test can be carried out.

In the talk the underlying physical principles of the novel ion source are presented along with numerous experimental results. Next to total pressure and low mass spectrum measurements, the capability of analyzing the gas composition up to 50 m/z at high repetition rates is evaluated. Use cases for different final applications will be discussed.

15 min. break