

Rudolph Jaeckel Award

“Nothing” but accurate

Dr. Karl Jousten

Physikalisch-Technische Bundesanstalt, Abbestr. 2-12, 10587 Berlin

karl.jousten@ptb.de

When measuring a physical quantity such as vacuum pressure, it is important that the indication of the instrument conforms to the International System of Units (SI). Normally, the user does not want to take care of this, but the manufacturers of the instruments and the calibration services need to.

Vacuum metrology is the science of the accurate measurement of vacuum. This does not only include the measuring instruments, but also the so-called primary standards for vacuum. Primary standards are at the top of the calibration hierarchy and use physical laws to realize the quantity. For pressure this is force per area, the ideal gas law or the conservation of mass flow as in the continuous expansion standard CE3 shown in the figure. More recently, the Lorentz–Lorenz equation in combination with the real gas law is used for primary standards using photonic methods. Such primary standards are mainly operated by National Metrology Institutes such as the Physikalisch-Technische Bundesanstalt (PTB).

This talk will give insight into the types of vacuum primary standards and explain the international system of metrology as organised by the Meter convention. The dissemination of the vacuum pressure scale is done by vacuum gauges acting as reference or transfer standards. Such gauges are stable and accurate enough to “transport” the calibration value in time and space. Recently, for the high vacuum range a novel ionisation gauge was developed for this purpose. This completed the availability of reference gauges from atmospheric pressure down to 10^{-6} Pa.

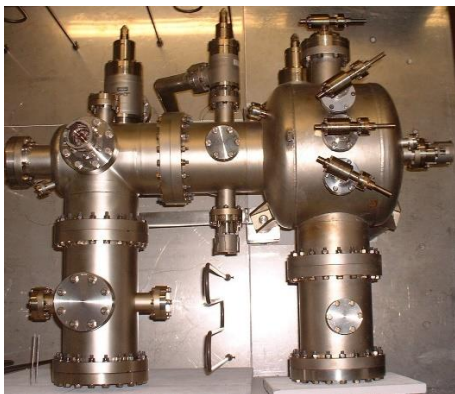


Figure: Primary standard CE3 for UHV at the Physikalisch-Technische Bundesanstalt (PTB) in Berlin