TEMPERATURE-STABILIZED MICRO WIRE PIRANI

Julian Eiler[1], Stefan Weber[2], Peter Gerlesberger[2], Heinz Plöchinger[2], Rupert Schreiner[1]
[1]Faculty of Applied Natural Sciences and Cultural Studies, OTH Regensburg, D-93053 Regensburg, Germany
[2]Thyracont Vacuum Instruments GmbH, D-94036 Passau, Germany

ABSTRACT

Pirani vacuum gauges are thermal sensors which generate a temperature gradient between the heated sensor element and a heat sink. This generates a heat flow towards the heat sink, which is usually thermally coupled to the ambient temperature. The amount of heat flow depends on the temperature difference between the heating element and the heat sink, as well as the thermal conductivity of the residual gas [1, 2]. Thus, the sensor signal is affected by changes in the ambient temperature, resulting in noise and drift in the sensor signal. The sensor presented in this work stabilizes the ambient temperature with additional heating structures [3].
The entire sensor assembly consists of three parts: Two temperature compensation planes and the actual sensor element. The entire assembly is built on a TO-socket with six pins. The temperature compensation planes are placed above and below the heated wire on the socket (Fig. 1). These temperature compensation planes contain metallic heating structures, which are patterned by photolithography and metallized by physical vapor deposition.
During operation, the temperature compensation planes compensate changes in the ambient temperature by heating them up to a constant temperature. This creates a constant temperature gradient between the sensor element and the heat sink.
The temperature compensation planes are kept on a stable temperature with an analog circuit. The sensor element can be driven in constant temperature mode, but also in simpler modes such as constant voltage. It can be shown that the noise level and sensor drifts can be reduced with the controlled temperature compensation planes.

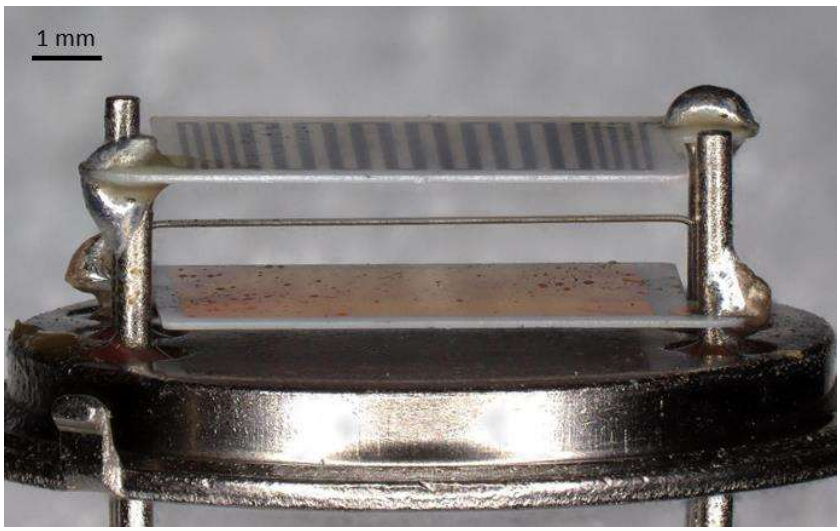

Fig. 1: Sensor assembly on a TO-socket based on micro-wire Pirani between two heat exchange planes

References

[1] Handbook of Vacuum Technology, edited by K. Jousten, 2nd ed. (Willey-VCH, Weinheim 2016).
[2] C. Langer, D. Berndt and R. Schreiner, J. Vac. Sci. Technol. B 40, 054203 (2022).
[3] H. Plöchinger, U.S. Patent, US2014/0026640 A1 (2014).