

Measurements of Helium Permeation in Zerodur glass used for the realisation of quantum pascal

Ardita Kurtishaj¹

Ibrahim Hameli¹, Arber Zeqiraj², Sefer Avdiaj^{1*}

¹ Department of Physics, University of Prishtina “Hasan Prishtina”, Prishtina 10000, Kosovo

² Department of Materials and Metallurgy, University of Mitrovica “Isa Boletini”, Mitrovica 40000, Kosovo

*sefer.avdiaj@uni-pr.edu

In the new optical pressure standard Ultra-Low Expansion glass (ULE) cavities were proposed to measure helium refractivity for a new realisation of the unit of pressure, pascal. However, it was noticed that the use of this type of material causes some difficulties. One of the main problems of ULE glass is the pumping effect for Helium [1]. Therefore, instead of ULE, Zerodur glass was proposed as a material for the cavity. This proposal was given by the Vacuum Metrology team of the Physikalisch-Technische Bundesanstalt - PTB in the QuantumPascal project. In order to calculate the flow of helium gas through Zerodur glass one has to know the permeation constant K . Moreover, the modelling of time dependency of the flow requires the knowledge of diffusion constant D as well. The relation between them is given by $K = S \cdot D$, where S is solubility of Helium in glass. In our research work we measured permeation of helium gas in Zerodur. The measurements were performed in the temperature range 27 – 120 °C. Based on our results, we consider that the Zerodur material has the potential to be used as cavity material for the new quantum standard of pressure.

References

- [1] S. Avdiaj, Y. Yang, K. Jousten, and T. Rubin, “Note: Diffusion constant and solubility of helium in ULE glass at 23 ° C,” J. Chem. Phys., vol. 148, no. 11, pp. 3–5, 2018, doi: 10.1063/1.5019015.