The influence of “Edge efefct” on determining the diffusion constant of Helium gas in ULE glass

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In recent years, new methods of calibrating gas pressure measurements are being developed, toward replacing primary standard of the SI unit of pressure, Pascal, by the quantum-based standard definition of it. In this context, many electromagnetic and thermodynamic properties of gases are expected to be more accurately measured and/or calculated. In this paper, we present a method, which we used to determine the diffusion constant of Helium in ULE glass, by means of outgassing rate dependence on time. We have used experimental data [1] for the dependence of the outgassing rate on time for three different ULE glass plates, with different geometrical dimensions. Instead of considering the plates semi-infinite, as it is usually done in most of the literature, we took into account all three dimensions of the plates by considering them rectangular shaped parallelepipeds and worked out the mathematical model of outgassing rate vs. time. Then, we found optimal value of the diffusion constant D, for which the mathematical model best fitted the data. Optimal value was obtained by least square method of fitting. From the computed values, we found the mean and uncertainty related values of D. Then we compare this result with the result of the semi-infinite model, and by this comparison, we can calculate the effect of the edge of the plate in determination of diffusion coefficient.

References

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