99 °C до 19 °C. Эти данные могут быть полезны для специалистов в области измерения влажности при оценке неопределенности объемной доли влаги. Использованы формулы и коэффициенты для определения давления водяного пара Hardy, которое оценивается с относительной неопределенностью ±0,005 % для диапазона измерения от 0 °C до 100 °C и ±(0,01–0,005×t) % для диапазона измерения от –100 °C до 0 °C [9].

Коэффициенты чувствительности с повышением температуры точки росы/инея при неизменном нормальном давлении находятся в диапазоне 0,0085 млн$^{-1}$ / °C ≤ $|C(e)|$ ≤ 1359,817 млн$^{-1}$ / °C. Следует отметить, что измерение объемной доли влаги по методу «одно давление (1-P) и одна температура (1-T)» в качестве значений давления в трубке равно атмосферному с учетом добавления неопределенности 40 Па. ■

Статья поступила в редакцию 1.11.2024

Analysis of the Uncertainty Assessment of the Moisture Volume Fraction Hygrometer

A.K. Zhumagali[1, 2], National Research Tomsk Polytechnic University, RSE Kazakhstan Institute of Standardization and Metrology, wap.aseke.kz@mail.ru
B.U. Baykhozhaeva[3], Gumilyov Eurasian National University, Prof. Dr. (Tech.), bajxozhaeva63@mail.ru

[1] Graduate Student, Tomsk, Russia
[2] Leading Specialist, Astana, Republic of Kazakhstan
[3] Head of Department, Astana, Republic of Kazakhstan

Citation: Zhumagali A.K., Baykhozhaeva B.U. Analysis of the Uncertainty Assessment of the Moisture Volume Fraction Hygrometer, *Kompetentnost' / Competency (Russia)*, 2025, no. 1, pp. 37–41. DOI: 10.24412/1993-8780-2025-1-37-41

key words

sensitivity coefficient, uncertainty, moisture volume fraction, pressure, dew point temperature

Measuring gas humidity in units of the moisture volume fraction is crucial in a wide range of scientific, industrial, and environmental applications. The moisture volume fraction provides an accurate and quantitative measurement of the moisture content in the gas. In the article we have analyzed the uncertainty assessment of the moisture volume fraction unit, reproducing the values measured in pressure and temperature units at a point using the one-pressure (1-P) and one-temperature (1-T) method. The values of dew point temperature sensitivity coefficients are proposed and equations for determining the sensitivity coefficients are disclosed. The effect of atmospheric pressure in the range from 84 kPa to 106 kPa on moisture volume fractions determined under normal atmospheric conditions is investigated. Calibrated using a barometer and a dew point hygrometer.

References

1. Cuccaro R., Rosso L., Smorgon D., etc., *Measurement Science and Technology*, 2018, vol. 29, no. 5, p. 054002; https://doi.org.10.1088/1361-6501/aaa785.
2. Sonntag D., *Meteorologische Zeitschrift*, 1994, vol. 3, no. 2, pp. 51–66; https://doi.org.10.1127/metz/3/1994/51.
3. Hardy B. ITS-90 Formulations for water vapor pressure, frost point temperature, dew point temperature, and enhancement factors in the range –100 °C to +100 °C, 3rd Int. Symposium on Humidity and Moisture, Teddington, *NPL*, 1998, vol. 1, pp. 214–222.
4. Wexler A., *Journal of Research of the National Bureau of Standards. Section-A. Physics and Chemistry*, 1976, vol. 80A, no. 5–6, pp. 775–785; https://doi.org.10.6028/JRES.080A.071.
5. Huang P. New equations for water vapor pressure in the temperature range –100 °C to +100 °C for use with the 1997 NIST/ASME steam tables, 3rd Int. Symposium on Humidity and Moisture, Teddington, *NPL*, 1998, vol. 1, pp. 68–76.
6. Hyland R. W., *Journal of Research of the National Bureau of Standards. Section-A. Physics and Chemistry*, 1975, vol. 79A, no. 4, pp. 551–560; https://doi.org.10.6028/JRES.079A.017.
7. Greenspan L., *Journal of Research of the National Bureau of Standards. Section-A. Physics and Chemistry*, 1976, vol. 80A, no. 1, pp. 41–44. https://doi.org.10.6028/JRES.080A.007.
8. Lovell-Smith J., *Metrologia*, 2009, vol. 46, no. 6, pp. 607–615; https://doi.org/10.1088/0026-1394/46/6/001.
9. Nielsen J., etc., *Measurement*, 2003, pp. 1–33.