Molar Heat Capacity at Constant Volume for Isobutane at Temperatures from (114 to 345) K and at Pressures to 35 MPa

*Richard A. Perkins and Joseph W. Magee**

Thermophysical Properties Division
Chemical Science and Technology Laboratory
National Institute of Standards and Technology
Boulder Colorado 80305-3337, U.S.A.

* Corresponding Author. E-mail: joe.magee@nist.gov

SUPPORTING INFORMATION:

Argon Triple Point Temperature Determination

The uncertainty in the calorimeter temperature determined with a standard platinum resistance thermometer (SPRT) was verified by measurements of the triple point temperature of argon with the suppliers stated purity of 99.9999 %. The triple point temperature of argon is a fixed point at 83.8058 K on the ITS-90 temperature scale[1]. A sample of this argon was frozen in the calorimeter cell at a temperature below its triple point. The sample was slowly heated until the temperature became nearly constant, indicating that the solid argon was melting. Heating was stopped to allow the temperature of the solid, liquid, and vapor argon to equilibrate within the calorimeter cell. The standard platinum resistance thermometer indicated a cell temperature of 83.809 K with a standard deviation of 0.0016 K over a period of one day at the triple point of argon. The value measured with the calorimeter is 0.003 K higher than the ITS-90 fixed point

temperature. This temperature offset could be attributed to either a small calibration shift or a gradient between the SPRT and the cell. A small gradient is likely because the SPRT is located outside but in good thermal contact with the cell wall in this calorimeter. Traditional triple point cells are designed so that the SPRT is surrounded by the fluid to eliminate such temperature gradients. Previously reported measurements of the triple point of nitrogen[2] with this cell gave similar results–the measurement deviated from the ITS accepted temperature by less than 0.002 K, which confirms that a calibration shift of the SPRT is an unlikely source of error. The noise level in the temperature measurement is characterized by the standard deviation of the averaged temperature of 0.0016 K. Thus, temperature noise is 0.003 K at a coverage factor of k=2.

Literature Cited

(1) Preston-Thomas, H. The international temperature scale of 1990 (ITS-90). *Metrologia* **1990,** *27*, 3-10.

(2) Magee, J. W. Molar heat capacity (C_v) for saturated and compressed liquid and vapor nitrogen from 65 to 300 K at pressures to 30 MPa. *J. Res. Natl. Inst. Stand. Technol.* **1991,** *96*, (6), 725-740.