Gas Saturation Method for Vapor Pressure Measurements: The Use of Antioxidant Additives for Oxidatively Unstable Compounds

Jason Widegren [C, S]
Applied Chemicals and Materials Division, NIST, Boulder, CO, U.S.A.
jason.widegren@nist.gov

Audrey Tolbert
Cell Biology and Biochemistry Department, Bucknell University, Lewisburg, PA, U.S.A.

Thomas Bruno
Applied Chemicals and Materials Division, NIST, Boulder, CO, U.S.A.

For thermophysical property measurements, one typically uses the purest samples available. However, there are circumstances where the use of a lower purity sample is advantageous. Perhaps the best example of this is when measurements are made near the limit of a sample's stability. In this situation, more accurate results may be obtained by the purposeful addition of an impurity that decreases the extent of sample decomposition during the measurement. We will illustrate such a case for vapor pressure measurements that were made by gas saturation. The gas saturation technique is based on the saturation of a carrier gas stream with the vapor of a condensed phase. The vapor is then stripped from a measured volume of the saturated carrier gas, the amount of vapor is determined, and the vapor pressure is calculated by assuming ideal gas behavior. One important advantage of the gas saturation method is that impurities have a relatively small and predictable effect on the measured vapor pressures. In our apparatus, the carrier gas flows through a series of eighteen "concatenated" saturator-adsorber pairs. In this way it is possible to make eighteen simultaneous vapor pressure measurements. By use of this apparatus, we were able to compare simultaneously measured vapor pressures for oxidatively unstable compounds with and without antioxidant additives. We also simultaneously measured the vapor pressure of an *n*-alkane control sample with a well-known vapor pressure curve.