

Concatenated Gas Saturation Apparatus for the Determination of Vapor Pressures: Measurements on Nitrotoluenes and Organic Aerosol Formers

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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. In our recently constructed apparatus, the carrier gas (SF_6) flows through a series of eighteen "concatenated" saturator-adsorber pairs. In this way it is possible to make eighteen simultaneous vapor pressure measurements, which greatly speeds data collection. After stopping the flow of carrier gas, the adsorbed material is eluted from each adsorber and analyzed by gas chromatography with flame ionization detection. The volume of carrier gas is determined by weighing the SF_6 supply cylinder before and after the flow of carrier gas, and then converting the mass of SF_6 to a volume with a high accuracy equation of state. An important advantage of the concatenated approach is that it allows for simultaneous measurements on a control sample with a well known vapor pressure curve. For this work, *n*-tetradecane was chosen as the control sample, in part because its vapor pressure curve is similar to the other compounds being measured. Measured values for the vapor pressure of *n*-tetradecane were the same as reference values (within our experimental uncertainty), which gives us confidence in the data collected simultaneously for the other compounds. We have used the apparatus to determine the vapor pressures of three nitrotoluene compounds and five organic aerosol forming compounds in the temperature range 283.15 K to 313.15 K. At these temperatures the measured vapor pressures range from approximately 1 Pa to 70 Pa, and have an expanded ($k = 2$) uncertainty of approximately 30 %.