

Magnetic Suspension Balance Setup for Simultaneous Saturated Liquid and Gas Phase Density Determinations

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Since more than 10 years the Laboratory for Thermophysical Properties (LTP) is a global service provider for the experimental determination of phase equilibria (e.g., vapor pressures, critical data, VLE, VLLE, or SLE), volumetric data like densities or density changes, caloric data such as enthalpy changes and heat capacities, and transport properties like viscosities, thermal conductivity or surface tension. For many properties the desired measurement condition is the saturated liquid and/or gas phase. Unfortunately, this condition is in most cases unfavorable for precise thermodynamic measurements where the homogeneous compressed liquid or the superheated gas phase state is preferred. However, this causes a much higher experimental effort and time to determine one saturated condition property by extrapolation of homogeneous phase measurements. In cooperation with Rubotherm (Bochum, Germany), LTP has now developed a new magnetic suspension balance (MSB) setup for simultaneous liquid and gas phase density experiments in a broad temperature (from -50 to +300 °C) and pressure range (up to 300 bar). Using a two sample body MSB system in combination with a high pressure cell with incorporated sample/injection ports, a stirring device and options for online GC sampling this setup provides new possibilities for combined density and phase equilibrium property determinations. Results on saturated liquid and gas phase densities for pure refrigerants like R134a (as reference fluid), R1234yf and some other new refrigerants will be presented. Other already tested applications are the determination of gas and liquid phase densities of aqueous amine solutions in equilibrium with different methane pressures.