**Dew-Point Densities of Fluid Mixtures - An Outlook for New Experimental and Modeling Approaches**

Markus Richter [C, S], Katharina Moritz and Reiner Kleinrahm
*Thermodynamics, Ruhr-University Bochum, Bochum, Germany*
*m.richter@thermo.rub.de*

Mark McLinden
*Applied Chemicals and Materials Division, NIST, Boulder, CO, U.S.A.*

Xiaoxian Yang and Christopher Tietz
*Thermodynamics, Ruhr-University Bochum, Bochum, Germany*

The study of the phase behavior of fluid mixtures is a major field in thermophysical property research. Accurate experimental data, in particular along the dew line, are needed to improve model predictions. Here we present experimental approaches to quantify the effects of sorption and capillary condensation, which exert a distorting influence on measured properties near the dew line. With a two-sinker densimeter and a tandem-sinker densimeter, both modified for sorption studies, we investigated the ($p$, $\rho$, $T$, $x$) behavior of binary ($CH_4$ + $C_3H_8$), (Ar + $CO_2$), and ($C_2H_6$ + $CO_2$) mixtures along isotherms starting at low pressures and increasing pressure towards the dew point. We observed three distinct regions: (1) marginal sorption effects at low pressures; (2) capillary condensation and surface wetting within approximately 98 % of the dew-point pressure; (3) bulk condensation. The true dew point lies presumably within the second region. Hence, to achieve the goal of significantly improving the data situation for dew-point pressures and densities of fluid mixtures, sorption phenomena near the dew point need to be accurately quantified. The present results demonstrate the first significant outcome of a comprehensive study dealing with sorption phenomena and their distorting effects on thermophysical property measurements near the dew line, and here we outline the future plans of our ongoing research. This will require a combination of experiment and modeling. To that end, the construction of a special four-sinker densimeter optimized for both gas-density measurement and for gravimetric sorption analysis is in progress. Moreover, molecular simulation is applied to obtain a qualitative understanding of the sorption processes on an atomistic level, which helps us to identify the location of the true dew point within the capillary condensation/wetting region. Simulation insights are combined with experimental results to develop an empirical model that accounts for, and corrects, sorption effects.