

Influence of Adsorption and Desorption on accurate Density Measurements of Gas Mixtures

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Because of physical reasons, the accurate measurement of the density of gas mixtures, e. g. natural gas, is unavoidably influenced by adsorption and desorption. When measuring the density of natural gas, disproportional distinct adsorption of the heavier hydrocarbons (as well as of CO₂) on the internal walls of the measuring device occurs (especially on the internal surfaces of the measuring cell, on the components inside the cell, in gaps, in pores, in dead spaces, gaskets, etc.). The consequence of this disproportional adsorption is a change in composition of the measured gas and, therefore, a change of the density inside the measuring cell. Moreover, desorption of adsorbed components from the internal walls of the measuring device can occur and can change the gas composition as well. This effect can be clearly observed during the density measurement along isotherms when measuring from high pressures, e. g. 8 MPa, down to low pressures, e. g. 0.5 MPa. Thereby, small amounts of gas, which are still in gaps, pores, dead spaces and gaskets within the measuring cell, diffuse at low pressures into the investigated gas mixture. The observations regarding the change in gas composition are not only affecting the accurate density measurement but also the measurement of other thermophysical properties, e.g. speed of sound measurement. Based on comprehensive density measurements, carried out with different densimeters developed at the thermodynamics institute of Ruhr-Universität Bochum, the presented investigations describe the influence of adsorption and desorption on the density measurements. To avoid a distortion of the measurements by the mentioned effects, appropriate measurement procedures have been established. These will be discussed in detail.