CO_2Mix Project: Experimental Investigation of Selected Thermo-Physical Properties of CO_2 Mixtures Relevant for CCS

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The ability to describe and predict the behavior of the fluids involved in the CCS chain is absolutely necessary for further development, design, and improvement of CCS processes. Knowledge of actual mixture behavior under the conditions of particular processes will allow identification of possible show-stoppers, specification of safe concentration limits for involved impurities, and design of efficient and safe processes.

For a range of relevant conditions within the CCS chain, there are still large gaps with insufficient experimental data characterizing CO_2 rich mixtures to describe system behavior with an acceptable level of accuracy. The aim of the research project CO_2Mix is to fill these gaps for selected mixtures and physical properties. The focus will be on properties and CO_2 mixtures that are relevant for CCS conditioning and transport. CO_2Mix is a KMB project (competence building project with client participation) under the CLIMIT program managed by the Research Council of Norway (RCN). The duration of CO_2Mix project is between 2010 and 2014, and the project is organized under the BIGCCS research center.

During the planning of CO_2Mix, it was decided to focus on measurements of phase behavior, speed of sound, and density. The phase equilibrium measurements will be performed by SINTEF Energy Research and NTNU in Trondheim, whereas the speed of sound and density measurements will take place in Ruhr-Universität Bochum. The phase equilibrium, speed of sound, and density measurements will use the same CO_2-rich mixtures, such that the data can be compared in existing models. The range of temperature and absolute pressure of the measurements will be between -60 and 150 °C and 1 and 200 bar, respectively. PhD candidates will be educated both in Bochum and in Trondheim. Through international cooperation, we hope that our results will be a part of a database that can be used to verify existing and develop new more accurate thermodynamic models for CO_2 mixtures.

This far, a literature study has been performed where knowledge gaps of relevant mixtures have been identified. Based on this, and input from the industrial partners of the project, specifications for the equipment and the measurements have been made. Currently, the design and development of the measurement rigs and equipment are being performed.

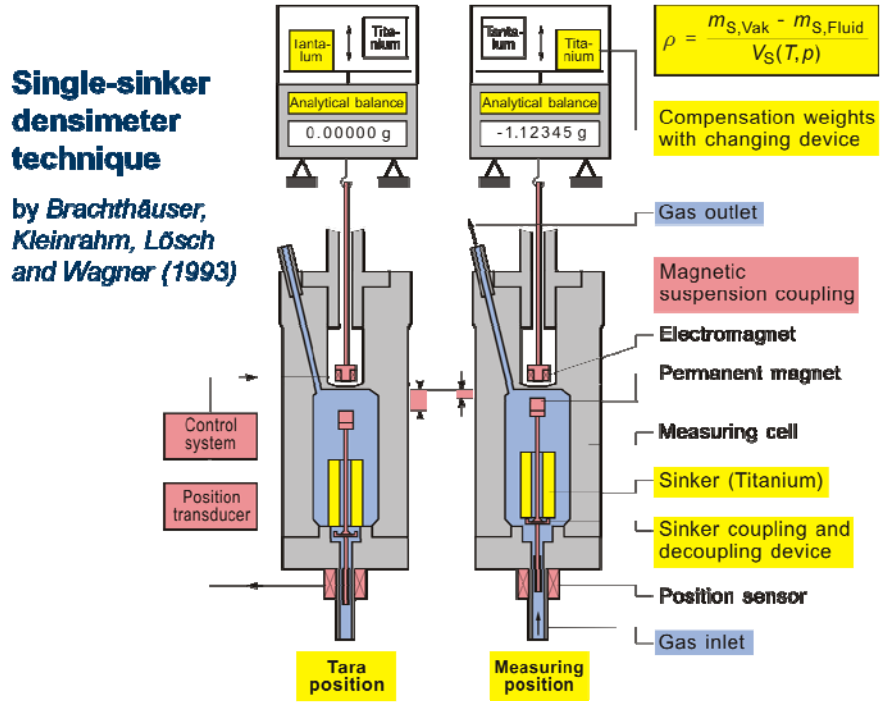

Figure 1: Single sinker densimeter

The density measurements will be performed using a single sinker instrument that is currently being finalized. The densimeter is based on a design originally developed at the Ruhr-Universität Bochum [1, 2]. Instruments of this design are internationally considered as a reference for highly accurate PVT measurements. The operation of the densimeter is illustrated in Figure 1. The speed of sound measurements will be performed using a dual-path time-of-flight cell using a technique originally developed at the Van der Walls Laboratories in the Netherlands. Both techniques / instruments are currently being adapted for measurements on CO_2-rich mixtures.

The phase equilibrium measurements will be performed using an analytical technique [3], i.e. the composition of all phases present at equilibrium will be measured. The phase equilibrium measurement rig is currently under development and design, and further details will be revealed during the conference.

References

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