Interfacial Tension Measurements of Binary Mixtures of N_2 + Brine and CO_2 + Hydrocarbon Systems at Conditions Relevant for CCS and EOR

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Interfacial tension (IFT) between hydrocarbons, gases and water/brines plays an important role in the assessment of injection strategies, capillary trapping capacity, and caprock seal security in deep saline aquifer sequestration of CO_2 and enhanced oil recovery in mature reservoirs. However, CO_2 captured is not pure, containing impurities such as N_2. There is a gap understanding interfacial interactions between N_2 from CO_2 streams and brines present in geological storage sites. This challenge aligns with a quest for characterising what happens at the interface between CO_2 and different types of hydrocarbons during CO_2 storage or usage in EOR. Experimental IFT data on these systems is still scarce in the literature, under representative reservoir conditions of temperature and pressure. Therefore, in this study, the interfacial tension of N_2 +brine, and CO_2 + hydrocarbon liquid systems at injection/storage geo-conditions will be investigated, as a key thermophysical property to enable carbon capture and storage (CCS) and enhanced oil recovery (EOR) strategies.

We will report new experimental data on interfacial tension of (1) N_2 + $NaCl_{\{aq\}}$ and N_2 + $CaCl_{2\{aq\}}$ systems, representative of monovalent and divalent salts present in the reservoirs with concentrations ranging from dilute to high salinity brines (1.0, 3.0, 5.0 mol kg^{-1}), and (2) CO_2 + cyclohexane and CO_2 + toluene systems. Measurements are made at temperatures from (298 to 423) K and pressures from (2.0 to 40.0) MPa, using the axisymmetrical drop shape analysis (ADSA) technique. The impact of temperature, pressure and salinity (molality and ion type) on the IFT was assessed using the data acquired from the measured systems.