Phase Barotropicity in Blends of CO_2 with Oil of Different Chemical Structures

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One of today's most significant environmental problems deals with CO_2 emissions, as they are considered responsible for an increment in the global average temperatures of more than 1°C. A substantial reduction of CO_2 emission is, however, not realistic making Carbon Capture and Storage (CCS) a good, sustainable option for our modern society.

When two phases in equilibrium, one rich in a light compound (even a supercritical gas) and another rich in a denser fluid, invert their densities, barotropicity occurs. Phase barotropic behaviour is a phenomenon that is experimentally and theoretically relatively well-known but which has encountered limited applications. One fluid that is well-known for developing such peculiar behavior is the CO_2 when blended with oils of different chemical structures. The sole idea that a light fluid, even a supercritical gas, may combine with a denser one so that, under some conditions, the light fluid rich phase may be the heavier one can lead to innovative technological propositions, particularly in the area of CCS.

In this work, the barotropic behaviour of CO_2 is experimentally studied when combined with oils of different chemical structures. In particular, it addresses whether some chemical structures may lead to barotropicity in ranges such that a more efficient and thermodynamically stable CCS approach may result. The study includes cases when a significant amount of natural gas is also present.