Interfacial tension measurements of *n*-dodecane/CO_2 from (298.15 to 573.15) K at pressures up to 10 MPa by pendant drop method

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In recent years, crude oil (a natural source of hydrocarbons) has become the main raw material for the production of liquid fuels and the majority of valuable chemical compounds. Nevertheless, other sources of hydrocarbons are being explored due to oil depletion or an increase in oil price on the world market. In this sense, the Fischer-Tropsch synthesis has received much attention for its potential to produce chemical feedstocks and liquid fuels without the production of environmentally harmful compounds encountered in direct hydrogenation. However, the conversion efficiency of the Fischer-Tropsch process is not very ideal [1]. To further optimize and improve the Fischer-Tropsch process, it is vital to understand the thermophysical properties of reactants and products involved in this process.

The interfacial tension, which is in connection with the stability of contacting fluid phase, is a crucial property for the understanding and eventual improvement of synthesis efficiency of liquid hydrocarbons. A number of methods for measuring the interfacial tension of two fluids are available [2]. But most methods are only suitable for experiments at ambient conditions and lack robustness and simplicity for implementation in a high pressure apparatus. The main method suitable for elevated pressures is the pendant drop method using axisymmetric drop shape analysis, based on integration of the Young-Laplace equation.

In the present study, a new high temperature and high pressure pendant drop apparatus was developed and tested with *n*-heptane over the temperature range from (298.15 to 498.15) K, and a good agreement between the experimental data and literature could be found. With the new apparatus, the interfacial tension measurements of *n*-dodecane/CO_2 were carried out over the temperature range from (298.15 to 573.15) K and at pressures up to 10 MPa. The combined expanded uncertainties of temperatures, pressures and interfacial tension with a level of confidence of 0.95 ($k = 2$) are estimated to be 18 mK, 12 kPa and less than 2.4% over the entire temperature and pressure range, respectively. Based on the experimental data, the interfacial tension is correlated according to van der Waals equation, and the deviations with the literature data are compared and analyzed.

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References

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