Viscosity measurements of *n*-dodecane and 2-butyl-1-octanol at temperatures from (298 to 475) K and pressures up to 10 MPa by vibrating-wire method

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Due to high oil price, energy safety and climate change, the Fischer-Tropsch synthesis has attracted much attention [1]. Through the Fischer-Tropsch process, synthesis gas ($CO + H_2$) from coal gasification can be converted into hydrocarbon and alcohol fuel with no sulfur and no nitrogen. Viscosity affects the fluid mobility and the heat and mass transfer rate, and further determines the power requirements for the pump and mixer. To further optimize and improve the Fischer-Tropsch process, it is vital to understand the viscosity of reactants and products involved in this process.

n-Dodecane and 2-butyl-1-octanol are two representative substances which are frequently involved in the synthesis of Fischer-Tropsch. The molecular structure of *n*-dodecane is similar to multicomponent hydrocarbons [2], and there are many viscosity data reported in literature for *n*-dodecane, so the viscosity measurement of *n*-dodecane can serve as a validation of the apparatus and supplement the existing experimental data as well. However, to the authors' best knowledge, the viscosity data of 2-butyl-1-octanol was mentioned only in one paper [3], and it merely shows a figure of the pressure-dependent viscosity of 2-butyl-1-octanol at 294 K, without exact data.

In the present work, a vibrating-wire apparatus was developed to measure the viscosity of *n*-dodecane and 2-butyl-1-octanol over the temperature range of (298 to 475) K with a total uncertainty less than ±20 mK, and at pressures up to 10 MPa with the accuracy of 0.1%. The expanded uncertainty of viscosity with a level of confidence of 0.95 ($k = 2$) is estimated to be 2.0%. The hard-sphere model was used to correlate the viscosity data. Besides, the average absolute deviation and the maximum absolute deviation between the experimental data and the calculated data from hard-sphere correlation were evaluated, respectively.

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References

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