Solubility of CO_2 in 2-butyl-1-octanol from (323.15 to 573.15) K at pressures up to 10 MPa

Xiaozhen Hu, Jian Yang, Xinyue Jia, Shengshan Bi, Jiangtao Wu*

Key Laboratory of Thermo-Fluid Science and Engineering of Ministry of Education,
Xi'an Jiaotong University, Xi'an, China
*jtwu@xjtu.edu.cn

China is rich in coal resources, whereas oil-gas resources are relatively in shortage. Currently, coal dominates the supply and consumption of energy in China, accounting for 69.6% of total energy production and 60.4% of total energy consumption in 2017 [1]. A majority of coal is directly combusted for power generation, steel and cement industries, and residential and commercial heating, which has caused severe energy waste and environmental problems. Therefore, in recent years, the Chinese government is now taking an active role to promote the utilization of clean coal technologies (CCTs), including clean coal power generation, coal conversion, pollution control and carbon capture. A number of factories using CCTs have already stepped into the commercialization stage [2].

Coal gasification combined with the Fischer-Tropsch process converting coal into synthetic liquid fuels is one of the promising CCTs. The Fischer-Tropsch process involves complex gas-liquid systems, primarily long chain hydrocarbons and its mixtures with H_2, CO, H_2O or CO_2 gases. The conversion efficiency of the Fischer-Tropsch process for coal is around 47.3% to 53.6% (lower heating value basis) [3]. 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.

2-Butyl-1-octanol ($C_{12}H_{26}O$) is one of the representative alcohols of the Fischer-Tropsch process and one of the most easily acquirable long chain alcohols. In this work, solubility of CO_2 in 2-butyl-1-octanol is measured by isochoric-saturation method over the temperature range of (323.15 to 573.15) K and at pressures up to 10 MPa. The expanded uncertainties (k = 2) of temperature, pressure and solubility are 20 mK, 1.6 kPa and 3%, respectively. The Peng-Robinson equation of state combined with the van der Waals mixing rule is used to correlated the experimental data.

Acknowledgments
The authors acknowledge the financial support of the National Natural Science Foundation of China (No. 51761135116).

References

[1] National Bureau of Statistics of China: *China Statistical Year book - 2018*. Beijing: China Statistics Press, 2018.
[2] S. Chang, J. Zhuo, S. Meng, S. Qin, Q. Yao: *Clean Coal Technologies in China: Current status and future perspectives*. Engineering **2**, 447-459 (2016).
[3] T. Takeshita, K. Yamaji: *Important roles of Fischer–Tropsch synfuels in the global energy future*. Energ. Policy **36**, 2773-2784 (2008).