Isothermal Vapor-Liquid Equilibria and Engineering EOS for the Ternary System of Methanol + Ethanol + n-Butanol and Its Constituent Binary Systems

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Since the temperature of the heat source for waste heat recovery cycles is lower than the temperature for conventional power plants, a working fluid that has lower boiling temperature, other than water, is needed. We have selected the mixture of 3 alkanols, (1)methanol, (2)ethanol and (3)n-butanol, as working fluids for the Lorentz cycle and measured isothermal VLE data of these binary and ternary mixtures in order to analyze the performance of the waste heat recovery cycle. The isothermal vapor-liquid equilibrium data for the ternary system of (1)methanol + (2)ethanol + (3)n-butanol and its constituent binary systems were measured by the one of static methods. The construction of the measurement apparatus is as same as Rarey and Gmehling's apparatus described in the literature [1]. We compared our binary data with literature data so that we confirmed the repeatability and the reliability of the measurements. Experimental data were correlated by the volume translated Peng-Robinson equation of state [2] in order to simulate thermodynamic power cycles in which these mixtures were used as the working fluid.

[1] Rarey, J. and Gmehling, J., Computer-operated differential static apparatus for the measurement of vapor-liquid equilibrium data, Fluid Phase Equilibria, 83, 1993, pp. 279-287.
[2] Ahlers, J. and Gmehling, J., Development of a Universal Group Contribution Equation of State. 2. Prediction of Vapor-Liquid Equilibria for Asymmetric Systems, Ind. Eng. Chem. Res., 41, 2002, pp. 3489-3498.