

A Prediction Method for Thermal Conductivity of Organic Compounds in the Liquid Phase up to the Critical Point

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New working fluids are proposed, almost every day, by researchers and chemical companies and are then introduced into the market. Those working fluids often originate from organic compounds and are likely to be binary or ternary mixtures of them. Following the demand for reliable data regarding transport properties, a prediction method for the thermal conductivity of organic compounds in the saturated liquid state and in the reduced temperature range from the boiling point up to the critical point is presented in this paper. Heat and mass transfer phenomena in organic compounds and their mixtures have been theoretically studied in the past from several different points of view. Despite these efforts, their behavior in the saturated liquid state cannot be easily predicted. Theoretical models are frequently inaccurate, while empirical methods are usually more accurate but are often specialized and tuned to cover a small number of compounds and/or a limited temperature range. Moreover, the latter methods often require the "a priori" knowledge of several experimental data in order to extract parameters. The aim of our work is to realize a very simple calculation method for the liquid thermal conductivity that is useful for engineering purposes. The method determines thermal conductivity as a sole function of the reduced temperature and requires the knowledge of a parameter dependent upon easily available physical constants characteristic of each compound. The method is validated against experimental data available in literature, giving average absolute deviations that are usually less than 5%, with maximum absolute deviations generally less than 10%. An extension of the method to estimate the thermal conductivity of binary and ternary mixtures is also presented, along with comparison with the experimental data available in the literature.