

A Model for the Calculation of the Thermal Conductivity for Binary Fluid Mixtures

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A simple model that represents the thermal conductivity of several binary fluid mixtures containing methane, ethane, propane, butane, nitrogen, and carbon dioxide has been developed. The model is similar to a previous method, which has been used for the prediction of viscosity of natural gas mixtures, over wide ranges of fluid states from dilute gas to dense liquid states. Gas kinetic theory has been incorporated into the model for improvement of the representation for dilute gas region. The critical region fluctuations of thermal conductivity are enhanced through a scaling law approach. The model takes advantage of currently available formulations and models for the density and thermal conductivity of pure fluid constituents of natural gases. The calculated thermal conductivity is compared with experimental data for methane-ethane mixtures, which covers a wide range of fluid states including dilute gas, super critical fluid, and liquid states. Comparisons are also made with available thermal conductivity data for binary systems of methane-butane, methane-nitrogen, methane-carbon dioxide, nitrogen-carbon dioxide, ethane-nitrogen, and ethane-carbon dioxide. The uncertainty of the model is estimated to be comparable to that of thermal conductivity formulations for constituent pure fluids with 1-2% in areas away from critical regions and about 5% in the critical region. It is expected that the model is applicable to multi-component systems.