Thermal Conductivity of Mixtures of R134a, R32, R125, and Propane

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Accurate models for the thermal conductivity of mixtures containing alternative refrigerants require data over a wide range of fluid conditions. Thermal conductivity data are reported for mixtures containing 1,1,1,2-tetrafluoroethane (R134a), difluoroethane (R32), pentafluoroethane (R125), and propane. The mixtures used in these measurements were prepared gravimetrically from pure materials at NIST. Care was taken to keep the mixtures in a single phase state during storage and filling of the apparatus. This insured that the composition of the mixtures studied was well known.

The data were obtained using two hot-wire instruments at temperatures from 220 to 400 K in the liquid, vapor, and supercritical gas phases. The low temperature hot-wire instrument used bare tungsten hot wires with a diameter of 4 µm at temperatures from 220 to 340 K. The high temperature hot-wire instrument used anodized tantalum hot wires with a diameter of 25 µm at temperatures from 300 to 400 K. The thermal conductivity of the gas phase was measured using both transient and steady-state techniques. The overlapping temperature range from 300 to 340 K allows the characterization of the uncertainties in the thermal conductivity data.

Comparisons are made between the thermal conductivity data and the NIST standard reference database package REFPROP. Comparisons are also made with other correlations which have been reported in the literature.