

Faculty of Mechanical Science and Engineering Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology

Thermophysical Properties of Refrigerants and Lubricant Refrigerant Mixtures

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Heat Conductivity

The knowledge of the heat conductivity of refrigerant-lubricant mixtures is crucial to understand and improve the heat transport within the compressor. By using a hot-wire bridge the heat conductivity can be calculated as the slope of temperature over the natural logarithm of the time.



After an initial time of approx. 0.5 to 1 second the heat conductivity is defined as the slope of temperature before convection is starting (approx. 8 seconds after the measurement), see figure 3.



Fig. 1: Measurement setup as two wire-bridge

Specific Heat Capacity and Enthalpy



Fig. 2: Schematic of the electric setup of the hot-wire measurement



Surface Tension of Fluids

Oil cooler calculations correspond to the specific heat capacity of the lubricantrefrigerant-mixture. The heat capacity is temperature and pressure dependent and varies with the amount of gas solved within the oil. Figure 4 shows exemplary measurements for different lubricants.

Besides the viscosity, the surface or interfacial tension affects the layer thickness of oil inside the compressor, bearings and the separation behavior inside the oil separator. By measuring the shape of a pendant drop the surface tension can be calculated using the shape factor Bond-number (Bo). Exemplary measurements are shown in Figure 6 and 7.



Dielectric strength

Especially with regard to drop-in refrigerants the dielectric strength of new blends and their mixtures with lubricants is of interest. To use a suction gas cooling for motors the dielectric strength of the fluid mixture must be high enough to prevent damage due to disruptive breakdown. The measurement is conducted using two spherical electrodes at 2.5 mm distance. The voltage is increased with a step width of 2 kV/s until a disruptive breakdown occurs.



σ

g

- Gravitational acceleration

Fig. 7: Drop shape of POE in carbon dioxide atmospheres

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