Viscosity of Some Ozone Safe Refrigerants in Liquid Phase: Experiment and Correlation

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To measure viscosity (μ) of refrigerants we applied the method of falling cylinder. The device constants were determined while carrying out the special calibrating test using *n*-hexane as a standard sample. It was estimated that the uncertainty in measurement of viscosity in liquid phase is less than 2.8%.

Experimental data on viscosity of liquid R134a, R152a and R32 were acquired in a pressure range from saturated liquid pressure up to 16 MPa. The temperature range was 290-360 K. Our experimental data on viscosity are in agreement with data obtained using capillary method. We approximate the data by the following model:

$$\mu = \mu_s \left[1 + \sum_{i=0}^{2} \sum_{j=1}^{2} K_y \tau^i \pi^j \right] \tag{1}$$

where $\pi = [(P - P_s)/(P_c - P_s)]^{1/3}$, $\tau = 1 - T/T_c$; P_c and T_c are the critical point parameters, and P_s is a saturated vapor pressure.

Viscosity at the saturated curve is presented by following equation where a regular part of viscosity at the critical point is a calculated constant:

$$\mu_s = \mu_c \exp\left(K_o \tau^{1/3} + \sum_{i=1}^{4} K_i \tau^i + M\tau^{11} \right) \tag{2}$$

A standard deviation of 1.13% in experimental and calculated values was obtained using this model. It gives possibility to calculate the viscosity of refrigerants investigated in liquid phase in the range of parameters of 260-360 K and up to 15 MPa with errors of not more than 3%.