

Measurements of the Specific Heat Capacity of R143a Using a Precision Flow Calorimeter

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Experimental thermodynamic information about alternative refrigerants, e.g. hydrofluorocarbons (HFCs), is indispensable for practical application. More accurate specific isobaric heat capacity (c_p) values for the refrigerants are especially important for establishing reliable thermodynamic equations of state and evaluating the reliability of existing equations of state. However, the c_p information for gaseous R143a is very limited, due to the difficulties in its measurement. In this work, the challenge was to measure gaseous state c_p values using a flow calorimeter, which was developed at Keio University, and was transferred to NDA in 2003. A stable and steady flow of sample gas is generated, and a heat flux is produced by a micro heater precisely inserted into the calorimeter tube. Each c_p data point is carefully determined by measuring the temperature increment values changing with the mass flow rate of R143a. Ten c_p data points have been measured for gaseous R143a, at temperatures from 311 to 343 K on three isobars from 1.6 to 2.4 MPa, close to the saturated vapor line. The experimental uncertainty is estimated to be from 0.016 to 0.035 kJ/(kg·K). The experimental data are compared with existing thermodynamic equations of state, which have been formulated on the basis of property data.