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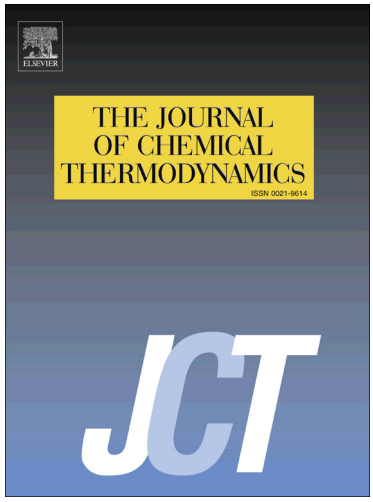

Adiabatic calorimeter for isochoric specific heat capacity measurements and experimental data of compressed liquid R1234yf

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Adiabatic calorimeter for isochoric specific heat capacity measurements and experimental data of compressed liquid R1234yf

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Abstract

In this paper, an adiabatic calorimeter has been developed to measure the isochoric specific heat capacity of compressed liquid. A spherical bomb with platinum resistance thermometer inserted was used to hold the measured liquid and two adiabatic shields were arranged to reduce the heat loss of thermal radiation. The isochoric specific heat capacity of liquid propane was measured over temperatures from (236 to 340) K and pressures up to 14 MPa. Satisfactory agreement with published heat capacity data is found and the reliability of the experimental setup is verified. Moreover, the experimental isochoric specific heat capacity data of liquid R1234yf were obtained in the temperatures from (240 to 341) K and pressures up to 13 MPa. The standard uncertainties were estimated to be 10 mK for temperature, 5 kPa for pressure and 1.0 % for isochoric specific heat capacity. The data of R1234yf are represented by two Helmholtz equations of state with average absolute relative deviations of 2.0 % and 1.3 %, respectively. Comparisons are made between the Helmholtz equations of state and the cubic equations of state for the calculation of the specific heat capacity property. The Helmholtz equations of state give a better description than the cubic equations of state, and the Peng−Robinson equation of state performs slightly better than the Patel−Teja and Soave−Redlich−Kwong equations of state.

Keywords: Adiabatic calorimeter; Isochoric heat capacity; R290; R1234yf; Equation of state

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