An Automated Flow Calorimeter for the Determination of Liquid Isobaric Heat Capacities

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Heat capacities belong among the basic thermophysical properties of a liquid. They are required for energy balances in chemical process design and control. Variations in heat capacities serve as a tool for understanding changes in the structure of liquid solutions. An automated flow calorimeter has been developed for the measurement of high accurate isobaric heat capacities over the range 250-400 K and 0-40 MPa. It can be used for pure compounds and mixtures. Two precision isocratic pumps deliver the liquids through the cell where a Peltier and a heater control the temperature, the inlet temperature is measured with RTD (100 ohm) and the outlet temperature is measured with a miniature thermistor periodically calibrated, the difference between both temperatures must be 0.5 K. The cell is immersed in a thermostatic bath with an estability of 0.5 mK. The estimated uncertainties in the measurement of the heat capacity are less than 0.5%. A complete automation system supplied all of the required data acquisition, monitoring, and control resources necessary to operate the calorimeter and make measurements from a single personal computer.

Measurements of isobaric heat capacities were performed on toluene, 1-hexene, n-hexane and cyclohexane to test the new calorimeter. These experiments compared well with the published values.