Flow Calorimeter for Specific Heat Capacity Measurement Based on Differential Method

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In order to study the specific heat capacity of the dilute solution, a flow calorimeter based on the differential method was developed. It is designed to obtain directly the ratio of the heat capacity of a solution to that of its solvent. It has a symmetrical double-cell structure, with one cell served as working part and the other served as reference part. Under steady flow rate and power input, a temperature gradient is established. When the same liquid is injected into both cells, under equal flow rates and power inputs, the final temperatures of both sides will be the same. When a liquid with different heat capacity replaces the liquid in the working cell, a difference in temperature gradient will disturb the temperature equilibrium of both cells. The measurement is accomplished by adjusting the power above the working cell to attain temperature equilibrium after the replacement, while the reference cell remains unchanged. The measurement is independent of the flow rate, the temperature change and the heat capacity of the cell. The system is designed to operate at temperatures from 278 to 343 K and at atmospheric pressure, and its uncertainty is less than 2%. Specific heat capacity of dilute solution of which molality is as low as 0.01 mol/kg can be effectively measured. The apparent molar heat capacities of aqueous NaCl in the range of 0.01 to 0.2 mol/kg were measured at 303 K to verify the accuracy of the system.