Continuous Flow Reaction Calorimeter based on Peltier elements

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Kinetic characterization of chemical reactions is crucial for process development and for thermal process safety. Reaction calorimetry in continuous flow is a powerful technique for kinetic studies and features higher yield and selectivity, facilitates process automation, reduces the ecological footprint and offers shorter process development times. [1, 2]

In this study, the automation strategy is developed for a continuous flow calorimeter based on Peltier elements (PE) and commercially available plate microreactors made of glass. Here, the isoperibolic operation mode of the calorimeter is investigated, in which the PEs are operated in passive mode as heat flux sensors. When a temperature difference is applied to a PE, a thermoelectric voltage is generated. This thermoelectric voltage is correlated with the heat flux going through the TEs using a suitable calibration method. Since multiple PEs are placed along the reaction channel, a local and temporal resolution of heat fluxes within the microreactor is therefore realized. At first, the calibration is tested by water flow experiments. For feasibility and validation of the calibration, the acid-base neutralization of HCl and NaOH is performed in different microreactors. In future, the safe investigation of highly exothermic reactions such as oxidation of thiosulfate with hydrogen peroxide is carried out determining thermokinetic data in isoperibolic operation mode.

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