Hydrodynamic and Heat Transfer Model of a Gas-Liquid Microreactor

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In recent years, microreactors have received an increasing attention thanks to the wide scope of their application in various fields of chemical technology. Unique features of microreactors, such as the extremely high surface-to-volume ratio, inherent safety or unprecedented control of local process conditions further contribute to wide utilization of microreactors as part of process intensification (PI) concepts. In order to fully exploit all PI features of the microreactor application for a given process, a hydrodynamic and a heat transfer model is essential. A well formulated mathematical model helps us determine the optimum microreactor geometry as well as the process conditions needed to achieve the desired PI targets.

In this contribution we present a hydrodynamic and heat transfer model of a microreactor for a gas-liquid reaction. In the course of formulation of the model, we considered the characteristic features of the studied system – the gas-liquid flow pattern and the change in physical properties induced by pressure and temperature variation along the microreactor. Based on the input information (gas and liquid flow rates, compositions, temperatures), the model calculates the two-phase pressure drop and outlet temperature as the principal result. These results serve as a basis for the design of an intensified pilot scale microreactor.