Hydraulic and thermal design of a gas microchannel heat exchanger

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Abstract
In this paper investigations on the design of a gas flow microchannel heat exchanger are described in terms of hydrodynamic and thermal aspects. The optimal choice for thermal conductivity of the solid material is discussed by analysis of its influences on the thermal performance of a micro heat exchanger. Two numerical models are built by means of a commercial CFD code (Fluent). The simulation results provide the distribution of mass flow rate, inlet pressure and pressure loss, outlet pressure and pressure loss, subjected to various feeding pressure values. Based on the thermal and hydrodynamic analysis, a micro heat exchanger made of polymer (PEEK) is designed and manufactured for flow and heat transfer measurements in air flows. Sensors are integrated into the micro heat exchanger in order to measure the local pressure and temperature in an accurate way. Finally, combined with numerical simulation, an operating range is suggested for the present micro heat exchanger in order to guarantee uniform flow distribution and best thermal and hydraulic performances.