Microchannel Reformate Cleanup: Water Gas Shift and Preferential Oxidation

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A fuel-cell powered car has the potential to provide greater fuel efficiency and less pollution than conventional internal combustion engines. Although on-board hydrogen storage technology is being pursued, an alternative approach is to process a liquid hydrocarbon fuel to produce a hydrogen-rich gas stream suitable for consumption by a fuel cell. DOE-EE/RE's FreedomCAR Program has tasked Pacific Northwest National Laboratory with applying microchannel architectures where appropriate in a fuel processing system to develop the technology to create a full-scale 50 kWe fuel processor that is less than one cubic foot in volume. As part of this work, a microchannel based water-gas shift reactor and preferential oxidation reactor have been developed to clean up the carbon monoxide from the reformer stream. The water-gas shift reactor uses a novel reactor that contains both adiabatic and an internally cooled differential temperature reactor sections to yield less than 1% carbon monoxidet at greater than 2 kWe flowrates. A 2 kWe preferential oxidation reactor was then developed using integral heat exchange to reduce the carbon monoxide in the water gas shift product to less than 10 ppm using an O_2:CO addition ratio of less than 1.2. The design of these reactors and the results of their testing will be discussed.