TABLE 1-continued

Average area heat flux (W/cm^2)	29.7	43.7	50.8	94.7	141.9
Equilibrium conversion temp. (° C.)	935	840	902	701	708
Equilibrium selectivity temp. (° C.)	924	846	901	776	792
Air inlet gas temperature (° C.)	932	880	930	856	887
Exhaust gas temperature (° C.)	940	884	938	872	917
Air inlet pressure (kPa)	124	123	127	148	190
Total fuel flow rate (SLPM)	0.152	0.184	0.222	0.454	0.693
Fuel H_2 content (%)	100	100	100	100	100
Air flow rate (SLPM)	0.460	0.460	0.554	1.135	2.095
% excess air (based on inlet flows)	27	5	5	5	27
Air pressure drop (kPa)	9.7	9.0	11.7	26.9	58.6
SMR inlet gas temperature (° C.)	915	860	906	810	814
SMR outlet gas temperature (° C.)	940	879	934	847	874
SMR inlet pressure (kPa)	2560 ± 5	2560 ± 5	2570 ± 5	2600 ± 5	2630 ± 5
SMR outlet pressure (kPa)	2560 ± 5	2560 ± 5	2570 ± 5	2570 ± 5	2560 ± 5
SMR CH_4 flow rate (SLPM)	0.182	0.326	0.326	1.264	1.82
SMR steam flow rate (SLPM)	0.547	0.980	0.980	3.78	5.46
Molar steam to methane Ratio	3.0	3.0	3.0	3.0	3.0
CH_4 conversion (GC Basis) (%)	93.0	77.6	89.1	44.3	45.7
Selectivity: CO (%)	69.5	60.2	67.4	47.3	50.6
SMR (carbon out)/(carbon in)	1.05	1.02	1.03	1.04	0.98
Web temperature 1.0 mm from catalyst fin upstream end (° C.)	953	906	953	900	950
Web temperature 2.8 mm from catalyst fin upstream end (° C.)	948	906	953	898	944
Web temperature 5.4 mm from catalyst fin upstream end (° C.)	943	901	949	888	930
Web temperature 17.2 mm from catalyst fin upstream end (° C.)	930	895	940	878	912
Web temperature 28.0 mm from catalyst fin upstream end (° C.)	929	886	933	864	893
Web temperature 39.2 mm from catalyst fin upstream end (° C.)	943	888	940	866	897
Furnace temperature (° C.)	935	883	934	864	902

EXAMPLE 2

[0124] Fins for use in a partial oxidation reaction process are designed and tested for methane partial oxidation to synthesis gas with focus on following characteristics:

[0125] 1. High CH_4 conversion: use of the fin should provide high CH_4 conversion.

[0126] 2. High H_2 Selectivity: use of the fin should provide high H_2 selectivity.

[0127] 3. High CO Selectivity: use of the fin should provide high CO selectivity.

[0128] 4. Low Pressure Drop: use of the fin should offer low resistance to flow.

[0129] 5. Mechanical and thermal strength: The fin should have high mechanical strength to sustain large stress conditions inside the channel during fabrication of the device (like bonding) and its operation. A design with good heat transfer characteristics prevents hot spots and material degradation.

[0130] **FIG. 6** shows the geometry of a fin that is useful for conducting a POX reaction process in a combustion microchannel. The trapezoidal shape of the fins provides mechanical rigidity at the base of fins. All the fins are supported on rectangular base to enhance heat transfer characteristics of the fin. The fin is fabricated from FeCrAlY using the Wire EDM method. The following table summarizes dimensions of the fin:

	Dimension (in)
Fin thickness	
At base	0.005
At top	0.002
Fin spacing	
At base	0.012
At top	0.017
Fin height	0.029
Rectangular base height	0.020