SUPPORTING INFORMATION

Oscillatory behavior in methane combustion: on the influence of the operating parameters

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Fig. SI1 – Photos of the JSFR used in Nancy (left) and the JSFR used in Napoli (right).

Fig. SI2 - Thermocouple located inside the Nancy reactor.

EXPERIMENTAL DATA

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1054	24	0.16
1063	19	0.33
1080	22	0.44
1082	18	0.64
1085	17	0.83
1101	2	2.08

Tab. SI1 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L1.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1089	18	0.39
1106	17	0.72
1116	11	0.94
1134	3	3.33
1159	2	4.35

Tab. SI2 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L2.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1096	18	0.47
1116	9	0.91
1128	12	1.23
1137	6	3.33

Tab. SI3 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L3.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1075	12	0.1
1100	8	0.2

1125	2	0.5

Tab. SI4 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L4.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1075	1.5	0.1
1100	9	0.1
1125	8	0.2
1150	7	0.2
1175	4	0.4
1200	3.5	0.6
1225	2	0.8

Tab. SI5 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L5.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1050	7	0.5
1075	12	0.3
1100	3	0.8
1125	2	1
1150	1	1

Tab. SI6 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L7.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1100	6	0.1
1125	4	0.5

Tab. SI7 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L8.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1025	30	0.15
1050	13	0.4

1075	10.5	0.6
1100	2	1.2

Tab. SI8 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case L9.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1100	61	0.15
1103	57	0.21
1110	50	0.35
1129	35	0.67
1159	37	0.65
1165	28	1.14

Tab. SI9 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S1.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1133	45	0.44
1153	42	0.63
1186	31	0.99
1212	21	1.37

Tab. SI10 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S2.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1116	25	0.25
1126	40	0.39
1137	20	0.72
1152	34	0.81
1158	20	1
1178	25	1.23
1182	13	2.08

Tab. SI11 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S3.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1100	14.5	0.075
1125	12.5	0.15
1150	10	0.2
1175	6	0.3
1200	5	0.6
1225	2	0.6

Tab. SI12 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S4.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1100	0.4	0.1
1125	14	0.075
1150	14	0.1
1175	11	0.15
1200	10	0.2
1225	8	0.3

Tab. SI13 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S5.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1050	26	0.1
1075	27	0.1
1100	19	0.2
1125	13.5	0.25
1150	10	0.4
1175	8	0.5
1200	6.5	0.6

1225	5	0.8

Tab. SI14 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S6.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1050	1	0.1
1075	22.5	0.1
1100	27.5	0.15
1125	20.5	0.2
1150	16.5	0.3
1175	13	0.4
1200	10.5	0.5
1225	7.5	0.6

Tab. SI15 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S7.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1050	50	0.15
1075	32	0.15
1100	25	0.35
1125	14	0.4
1150	12.5	0.6
1175	7	0.8
1200	6.5	1.2
1225	5.5	1.4

Tab. SI16 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S8.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1050	8	0.1
1075	35	0.2

1100	25	0.3
1125	20	0.45
1150	14.5	0.5
1175	11	0.7
1200	8	0.8
1225	5.5	1.1

Tab. SI17 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case S9.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1150	2	1
1175	8	0.1
1200	5.5	0.15
1225	5	0.2

Tab. SI18 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case R2.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1100	12	0.1
1125	15	0.3
1150	17	0.3
1175	22	0.35
1200	20	0.4
1225	17	0.6

Tab. SI19 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case R4.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1050	3	1
1075	6	1
1100	10	0.5

1125	5	0.8
1150	4	1
1175	4	1
1200	3	1
1225	3	1

Tab. SI20 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case R6.

T_{in} [K]	Oscillation amplitude [K]	Oscillation frequency [Hz]
1184	30	0.72
1208	3	3.3

Tab. SI21 – Experimental oscillation amplitudes and frequencies as a function of T_{in} for case R8.

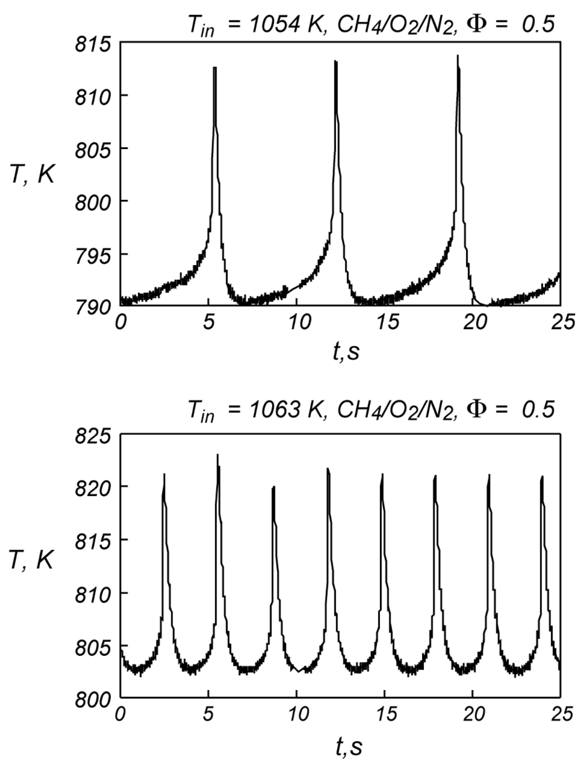

Fig. SI3 – Representative experimental temporal temperature profiles obtained at $\Phi = 0.5$ in N_2 bath gas with $X_{CH4} = 0.02$ and $\tau = 0.5$ s at $T_{in} = 1054$ K and $T_{in} = 1063$ K. The initial time is arbitrary.

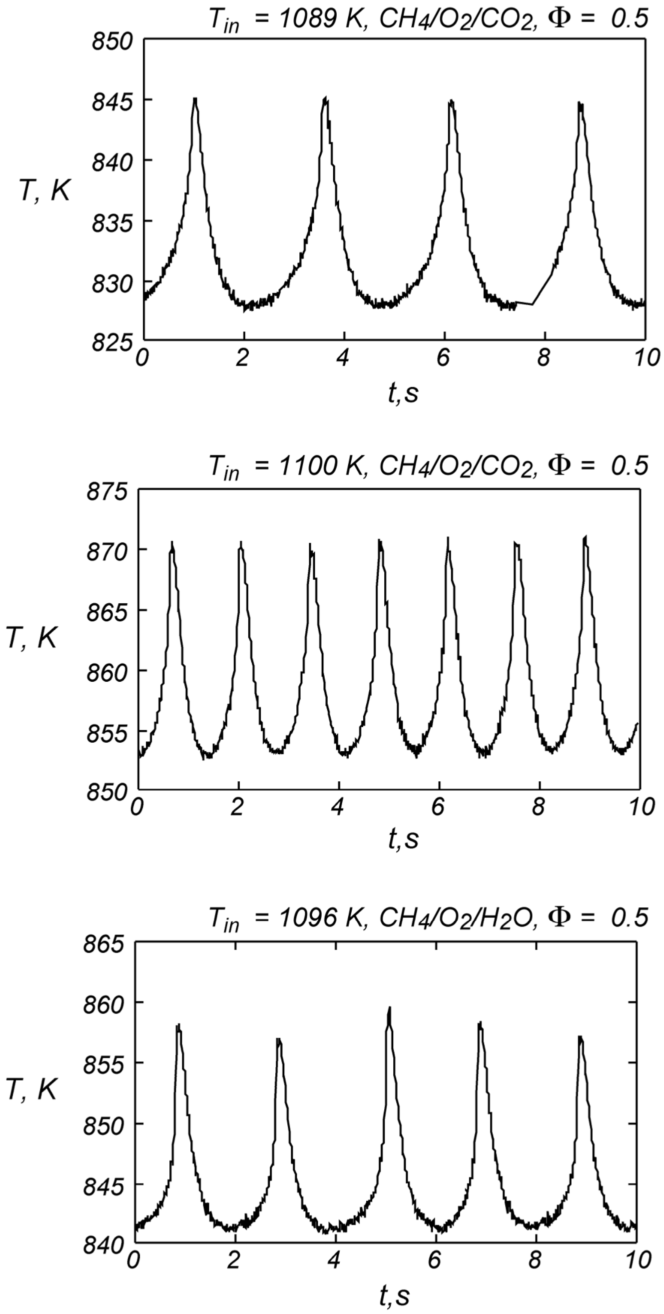

Fig. SI4 – Representative experimental temporal temperature profiles obtained at $\Phi = 0.5$ with $X_{CH4} = 0.02$ and $\tau = 0.5$ s in CO_2 bath gas at $T_{in} = 1089$ K and $T_{in} = 1106$ K and in N_2-H_2O bath gas at $T_{in} = 1096$ K. The initial time is arbitrary.

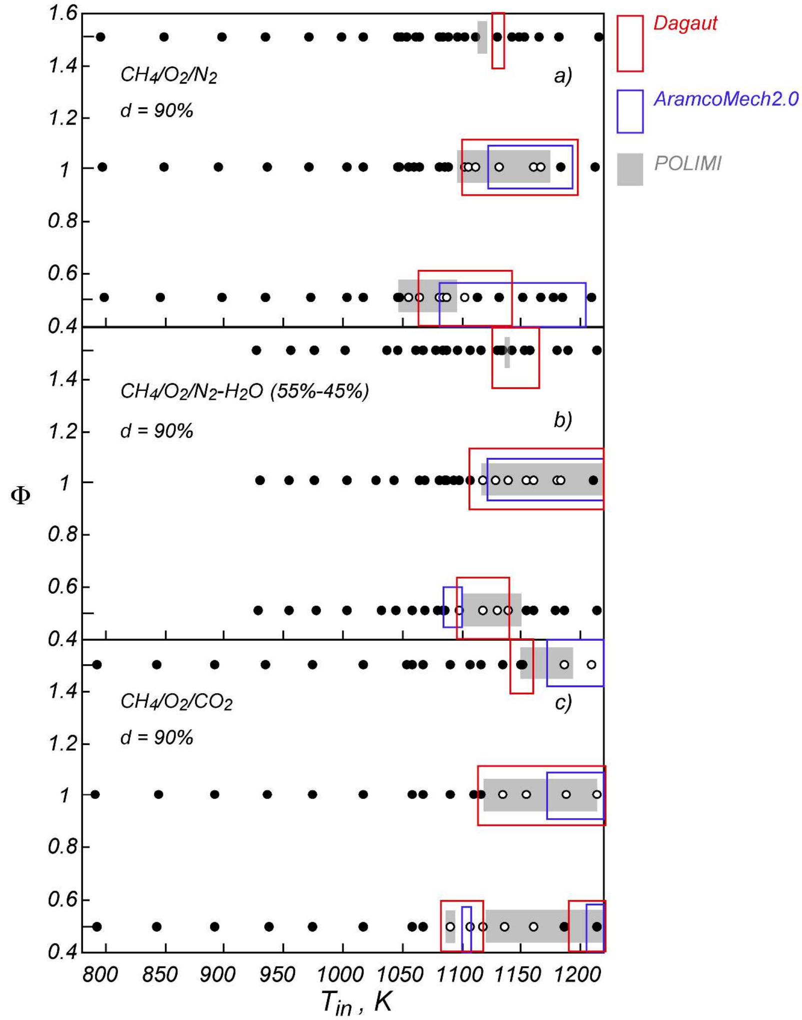

Fig. SI5 – Experimental (symbols) and simulated (rectangles) T_{in} - Φ maps. $\tau = 0.5$ s, $P = 1.1$ atm, $X_{bath\ gas} = 0.9$. (a) N_2 bath gas, (b) N_2-H_2O bath gas, (c) CO_2 bath gas. Closed circles: "no oscillation"; open circles: "oscillation"; grey rectangles: numerical oscillatory conditions simulated with the "POLIMI"[1] model, blue rectangles: numerical oscillatory conditions simulated with the "AramcoMech2.0"[2] model, red rectangles: numerical oscillatory conditions simulated with the "Dagaut"[3] model.

(1) Ranzi, E.; Cavallotti, C.; Cuoci, A.; Frassoldati, A.; Pelucchi, M.; Faravelli, T. *Combust. Flame* **2015**, 162(5), 1679-1691.

(2) Zhou, C-W; Li, Y.; O'Connor, E.; Somers, K.P.; Thion, S.; Keesee, C.; Mathieu, O.; Petersen, E.L.; DeVerter, T.A.; Oehlschlaeger, M.A.; Kukkadapu, G.; Sung, C-J.; Alrefae, M.; Khaled, F.; Farooq, A.; Dirrenberger, P.; Glaude, P-A.; Battin-Leclerc, F.; Santner, J.; Ju, Y.; Held, T.; Haas, F.M.; Dryer, F.L.; Curran, H.J. *Combust. Flame* **2016**, 167, 353-379.

(3) Le Cong, T.; Bedjanian, E.; Dagaut, P. *Combust. Sci. Technol.* **2010**, 182(4-6), 333-349

As can be seen from Fig. SI5, simulations using different kinetic mechanisms lead to noteworthy disagreement among model predictions themselves (note that the used mechanisms are the best performing).

The POLIMI mechanism was chosen as reference scheme because it was one of the most reliable in predicting oscillatory behaviors.