

Kinetic Study of Non-Equilibrium Plasma-Assisted Methane Steam Reforming

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Supporting Information

Appendix A: Electron-impact reactions and the rate constants S3

Appendix B: Radical reactions and the rate constants..... S4

Appendix A:

Electron-impact reactions and rate constants¹

no.	reactions	Threshold	A_r	β_r	E_r
1	$E + CH_4 \Rightarrow E + CH_4$	0.162	5.08E-07	-2.82E-01	5.97E+04
2	$E + CH_4 \Rightarrow E + CH_4$	0.361	1.26E-04	-7.45E-01	8.56E+04
3	$E + CH_4 \Rightarrow E + CH_3 + H$	9.00	2.29E-04	-7.17E-01	2.95E+05
4	$E + CH_4 \Rightarrow E + CH_2 + H_2$	10.00	3.47E-03	-9.59E-01	3.44E+05
5	$E + CH_4 \Rightarrow E + CH + H_2 + H$	11.00	6.67E-06	-4.83E-01	3.05E+05
6	$E + CH_4 \Rightarrow E + C + 2H_2$	12.00	1.90E-05	-5.78E-01	3.35E+05
7	$E + H_2O \Rightarrow E + H_2O$	0.206	1.01E-08	-6.71E-01	4.73E+03
8	$E + H_2O \Rightarrow E + H_2O$	0.459	6.65E-09	8.19E-02	2.20E+04
9	$E + H_2O \Rightarrow E + H_2O$	1.058	1.04E-08	-6.37E-02	4.86E+04
10	$E + H_2O \Rightarrow E + H_2O$	8.445	2.42E-07	-1.76E-01	2.43E+05
11	$E + H_2O \Rightarrow E + H_2O$	14.052	5.98E-07	-2.22E-01	4.35E+05
12	$E + H_2O \Rightarrow E + OH + H$	7.00	4.29E-09	1.20E-01	1.91E+05
13	$E + H_2O \Rightarrow O + H_2 + E$	13.00	5.01E-09	1.20E-01	3.93E+05
14	$E + C_2H_6 \Rightarrow CH_3 + CH_3 + E$	7.53	9.22E-09	1.71E-01	1.66E+05
15	$E + C_2H_6 \Rightarrow C_2H_5 + H + E$	10.12	1.81E-06	-1.92E-01	2.88E+05
16	$E + C_2H_4 \Rightarrow CH_2 + CH_2 + E$	7.462	1.86E-08	5.95E-02	1.75E+05
17	$E + C_2H_4 \Rightarrow C_2H_3 + H + E$	5.00	2.46E-10	4.95E-01	1.24E+05
18	$E + C_2H_2 \Rightarrow CH + CH + E$	7.902	3.34E-06	-2.77E-01	1.67E+05
19	$E + C_2H_2 \Rightarrow C_2H + H + E$	5.089	1.90E-03	-1.05E+00	1.49E+05
20	$E + CH_4 \Rightarrow CH_4^+ + 2E$	13.00	2.13E-08	1.20E-01	3.59E+05
21	$E + CH_4 \Rightarrow CH_3^+ + H + 2E$	14.3	2.20E-08	1.20E-01	4.08E+05
22	$E + CH_4 \Rightarrow CH_3 + H^-$	7.7	1.60E+01	-2.35E+00	2.52E+05
23	$E + CH_4 \Rightarrow CH_2^- + H_2$	9.00	1.35E+01	-2.39E+00	2.90E+05
24	$E + H_2O \Rightarrow OH^- + H$	3.28	6.99E-10	-3.35E-01	9.34E+04
25	$E + H_2O \Rightarrow H^- + OH$	4.36	5.36E-04	-1.26E+00	1.08E+05
26	$E + H_2O \Rightarrow H_2 + O^-$	3.58	3.34E-05	-1.13E+00	1.44E+05
27	$E + CH_3 \Rightarrow CH_3^+ + 2E$	10.0	8.53E-11	5.19E-01	1.99E+05

¹Reaction rate coefficient $k_r = A_r T^{\beta_r} \exp(-E_r/T)$, Units: A_r , cm³·molecules⁻¹·s⁻¹·K; β_r , dimensionless; E_r , (Ea/R), K.

28	$E + CH_3 \Rightarrow CH_2 + H + 2E$	15.0	1.38E-08	3.54E-01	2.47E+01
29	$E + CH_2 \Rightarrow CH_2 + 2E$	11.0	2.31E-10	4.42E-01	2.15E+05
30	$E + CH \Rightarrow CH + H + 2E$	16.0	1.72E-10	4.00E-01	2.99E+05
31	$E + CH \Rightarrow CH + 2E$	11.0	6.16E-10	3.65E-01	2.30E+05
32	$E + CH \Rightarrow C + H + 2E$	16.0	9.24E-11	4.18E-01	3.16E+05
33	$E + H_2 \Rightarrow H + H + E$	8.90	9.91E-04	-9.37E-01	2.31E+05

Appendix B:

Radical reactions and rate constants

no.	reactions	A_r	β_r	E_r	no.	reactions	A_r	β_r	E_r
34	$CH_3 + CH_2 \Rightarrow C_2H_4 + H$	1.50E-07	-1.17	320.0	105	$C_2H_5 + CH_3OH \Rightarrow C_2H_6 + CH_3O$	2.39E-23	3.10	4500.0
35	$CH_3 + H \Rightarrow H_2 + CH_2$	7.01E-11	0.00	0.0	106	$C_2H_5 + CH_3O \Rightarrow C_2H_6 + CH_2O$	4.00E-11	0.00	0.0
36	$CH_3 + H \Rightarrow CH_4$	1.00E-10	0.00	7600.0	107	$C_2H_5 + CH_2O \Rightarrow C_2H_6 + HCO$	9.14E-21	2.81	2950.0
37	$CH_2 + CH_2 \Rightarrow C_2H_2 + H_2$	2.01E-09	-0.40	0.0	108	$C_2H_5 + HCO \Rightarrow C_2H_6 + CO$	2.01E-10	0.00	0.0
38	$CH_2 + H \Rightarrow CH + H_2$	2.62E-09	0.00	6010.0	109	$C_2H_5 + O \Rightarrow CH_2O + CH_3$	2.67E-11	0.00	0.0
39	$CH_3 + OH \Rightarrow CH_3OH$	1.00E-11	0.00	-900.0	110	$C_2H_5 + O \Rightarrow C_2H_4 + OH$	6.31E-12	0.00	0.0
40	$CH_2 + OH \Rightarrow CH_2O + H$	1.04E-10	-0.02	-16.8	111	$C_2H_3 + C_2H_6 \Rightarrow C_2H_4 + C_2H_5$	9.99E-22	3.30	5280.0
41	$CH + H \Rightarrow C + H_2$	3.01E-11	0.00	0.0	112	$C_2H_3 + C_2H_3 \Rightarrow C_2H_4 + C_2H_2$	1.60E-12	0.00	0.0
42	$CH_3OH + OH \Rightarrow CH_3O + H_2O$	1.31E-10	0.00	80.6	113	$C_2H_3 \Rightarrow C_2H_2 + H$	6.81E+17	-7.49	22900.0
43	$CH_3OH + CH_2 \Rightarrow CH_3O + CH_3$	2.88E-23	3.40	-575.0	114	$C_2H_5 \Rightarrow C_2H_4 + H$	3.06E+10	0.95	18600.0
44	$CH_3OH + CH_3 \Rightarrow CH_3O + CH_4$	2.39E-23	3.10	3490.0	115	$C_2H_3 + CH_4 \Rightarrow C_2H_4 + CH_3$	2.41E-24	4.02	2750.0
45	$CH_3O + H \Rightarrow CH_3OH$	2.39E-23	3.10	3490.0	116	$C_2H_3 + CH_3 \Rightarrow C_2H_2 + CH_4$	1.24E-03	-3.20	0.0
46	$CH_3O + OH \Rightarrow CH_2O + H_2O$	4.05E-11	0.24	-26.5	117	$C_2H_3 + CH_3 \Rightarrow C_3H_6$	1.20E-10	0.00	0.0
47	$CH_3O + CH_3 \Rightarrow CH_2O + CH_4$	3.01E-11	0.00	0.0	118	$C_2H_3 + CH_2 \Rightarrow C_2H_2 + CH_3$	3.01E-11	0.00	0.0
48	$CH_3O + CH_4 \Rightarrow CH_3OH + CH_3$	4.00E-11	0.00	0.0	119	$C_2H_3 + CH_3OH \Rightarrow C_2H_4 + CH_3O$	2.39E-23	3.10	3490.0
49	$CH_3O + CH_2 \Rightarrow CH_2O + CH_3$	2.61E-13	0.00	4450.0	120	$C_2H_3 + CH_3O \Rightarrow CH_2O + C_2H_4$	4.00E-11	0.00	0.0
50	$CH_2O + CH_2 \Rightarrow CH_3 + HCO$	3.01E-11	0.00	0.0	121	$C_2H_3 + CH_2O \Rightarrow C_2H_4 + HCO$	6.40E-21	2.87	2950.0
51	$CH_2O + CH_3 \Rightarrow CH_4 + HCO$	1.00E-14	0.00	0.0	122	$C_2H_3 + HCO \Rightarrow C_2H_4 + CO$	5.00E-07	0.00	0.0
52	$CH_2O + H \Rightarrow H_2 + HCO$	1.29E-31	6.10	990.0	123	$C_2H_3 + H \Rightarrow C_2H_4$	6.46E-11	0.20	0.0
53	$CH_2O + OH \Rightarrow HCO + H_2O$	3.79E-14	1.05	1650.0	124	$C_2H_3 + H \Rightarrow C_2H_2 + H_2$	2.01E-11	0.00	0.0
54	$HCO + H \Rightarrow CO + H_2$	5.69E-15	1.18	-225.0	125	$C_2H_3 + OH \Rightarrow C_2H_2 + H_2O$	5.00E-11	0.00	0.0
55	$HCO + OH \Rightarrow CO + H_2O$	1.50E-10	0.00	0.0	126	$C_2H_3 + O \Rightarrow C_2H_2 + OH$	1.76E-12	0.20	-215.0

56	$\text{HCO} + \text{CH}_4 \Rightarrow \text{CH}_2\text{O} + \text{CH}_3$	1.69E-10	0.00	0.0	127	$\text{C}_2\text{H}_4 + \text{CH}_2 \Rightarrow \text{C}_3\text{H}_6$	5.00E-17	0.00	0.0
57	$\text{HCO} + \text{CH}_3 \Rightarrow \text{CH}_4 + \text{CO}$	1.06E-24	3.78	10700.0	128	$\text{C}_2\text{H}_2 + \text{H} \Rightarrow \text{C}_2\text{H} + \text{H}_2$	1.00E-10	0.00	11200.0
58	$\text{HCO} + \text{CH}_2 \Rightarrow \text{CO} + \text{CH}_3$	2.01E-10	0.00	0.0	129	$\text{CH}_4 + \text{H} \Rightarrow \text{H}_2 + \text{CH}_3$	6.62E-21	3.16	4410.0
59	$\text{HCO} + \text{H}_2\text{O} \Rightarrow \text{CH}_2\text{O} + \text{OH}$	3.01E-11	0.00	0.0	130	$\text{CH}_4 + \text{OH} \Rightarrow \text{CH}_3 + \text{H}_2\text{O}$	1.68E-18	2.18	1230.0
60	$\text{O} + \text{C}_2\text{H}_4 \Rightarrow \text{CH}_3 + \text{HCO}$	3.86E-16	1.35	13100.0	131	$\text{CH}_4 + \text{CH}_2 \Rightarrow \text{CH}_3 + \text{CH}_3$	3.01E-19	0.00	0.0
61	$\text{O} + \text{C}_2\text{H}_2 \Rightarrow \text{CO} + \text{CH}_2$	2.19E-16	1.55	215.0	132	$\text{CO}_2 + \text{CH}_2 \Rightarrow \text{CH}_2\text{O} + \text{CO}$	3.90E-14	0.00	0.0
62	$\text{O} + \text{CH}_4 \Rightarrow \text{CH}_3 + \text{OH}$	6.78E-16	1.50	850.0	133	$\text{CO}_2 + \text{H} \Rightarrow \text{CO} + \text{OH}$	2.51E-10	0.00	13400.0
63	$\text{O} + \text{CH}_3 \Rightarrow \text{CH}_2\text{O} + \text{H}$	1.15E-16	1.56	4270.0	134	$\text{CO} + \text{C}_2\text{H}_4 \Rightarrow \text{C}_2\text{H}_3 + \text{HCO}$	2.51E-10	0.00	45600.0
64	$\text{O} + \text{CH}_3 \Rightarrow \text{CH}_3\text{O}$	1.40E-09	0.00	0.0	135	$\text{CO} + \text{CH}_3\text{O} \Rightarrow \text{CO}_2 + \text{CH}_3$	2.61E-11	0.00	5940.0
65	$\text{O} + \text{CH} \Rightarrow \text{CO} + \text{H}$	9.18E-11	0.05	-68.6	136	$\text{CO} + \text{OH} \Rightarrow \text{CO}_2 + \text{H}$	1.05E-17	1.50	-250.0
66	$\text{O} + \text{CH} \Rightarrow \text{C} + \text{OH}$	6.59E-11	0.00	0.0	137	$\text{H}_2 + \text{C}_2\text{H}_5 \Rightarrow \text{C}_2\text{H}_6 + \text{H}$	5.10E-24	3.60	4250.0
67	$\text{O} + \text{CH}_3\text{OH} \Rightarrow \text{CH}_3\text{O} + \text{OH}$	2.52E-11	0.00	2380.0	138	$\text{H}_2 + \text{C}_2\text{H}_4 \Rightarrow \text{C}_2\text{H}_5 + \text{H}$	1.69E-11	0.00	34300.0
68	$\text{O} + \text{CH}_3\text{O} \Rightarrow \text{CH}_2\text{O} + \text{OH}$	1.66E-11	0.00	2360.0	139	$\text{H}_2 + \text{C}_2\text{H}_2 \Rightarrow \text{C}_2\text{H}_4$	5.00E-13	0.00	19600.0
69	$\text{O} + \text{CH}_2\text{O} \Rightarrow \text{HCO} + \text{OH}$	1.00E-11	0.00	0.0	140	$\text{H}_2 + \text{C}_2\text{H}_2 \Rightarrow \text{C}_2\text{H}_3 + \text{H}$	4.00E-12	0.00	32700.0
70	$\text{O} + \text{HCO} \Rightarrow \text{CO} + \text{OH}$	6.92E-13	0.57	1390.0	141	$\text{H}_2 + \text{CH}_3 \Rightarrow \text{CH}_4 + \text{H}$	1.14E-20	2.74	4740.0
71	$\text{O} + \text{HCO} \Rightarrow \text{CO}_2 + \text{H}$	5.00E-11	0.00	0.0	142	$\text{H}_2 + \text{CH}_2 \Rightarrow \text{CH}_3 + \text{H}$	5.00E-15	0.00	0.0
72	$\text{O} + \text{H}_2\text{O} \Rightarrow \text{OH} + \text{OH}$	4.98E-11	0.00	0.0	143	$\text{H}_2 + \text{CH} \Rightarrow \text{CH}_3$	8.93E-11	0.15	0.0
73	$\text{C}_2\text{H}_6 + \text{H} \Rightarrow \text{C}_2\text{H}_5 + \text{H}_2$	8.21E-14	0.95	8570.0	144	$\text{H}_2 + \text{CH} \Rightarrow \text{CH}_2 + \text{H}$	5.51E-16	1.79	840.0
74	$\text{C}_2\text{H}_6 + \text{OH} \Rightarrow \text{C}_2\text{H}_5 + \text{H}_2\text{O}$	5.19E-22	3.50	2600.0	145	$\text{H}_2 + \text{CH}_3\text{O} \Rightarrow \text{CH}_3\text{OH} + \text{H}$	2.11E-25	4.00	2470.0
75	$\text{C}_2\text{H}_6 + \text{O} \Rightarrow \text{C}_2\text{H}_5 + \text{OH}$	2.74E-18	2.22	373.0	146	$\text{H}_2 + \text{CH}_2\text{O} \Rightarrow \text{CH}_3\text{OH}$	2.28E-11	0.00	35100.0
76	$\text{C}_2\text{H}_6 + \text{CH}_3 \Rightarrow \text{C}_2\text{H}_5 + \text{CH}_4$	1.66E-15	1.50	2920.0	147	$\text{H}_2 + \text{HCO} \Rightarrow \text{CH}_2\text{O} + \text{H}$	3.00E-18	2.00	8970.0
77	$\text{C}_2\text{H}_6 + \text{CH}_2 \Rightarrow \text{C}_2\text{H}_5 + \text{CH}_3$	9.12E-25	4.00	4170.0	148	$\text{H}_2 + \text{OH} \Rightarrow \text{H}_2\text{O} + \text{H}$	3.50E-16	1.52	1740.0
78	$\text{C}_2\text{H}_6 + \text{CH}_3\text{O} \Rightarrow \text{CH}_3\text{OH} + \text{C}_2\text{H}_5$	1.07E-11	0.00	3980.0	149	$\text{H}_2 + \text{O} \Rightarrow \text{OH} + \text{H}$	8.52E-20	2.67	3160.0
79	$\text{C}_2\text{H}_6 + \text{HCO} \Rightarrow \text{CH}_2\text{O} + \text{C}_2\text{H}_5$	4.00E-11	0.00	3570.0	150	$\text{H}_2\text{O} + \text{C}_2\text{H}_5 \Rightarrow \text{C}_2\text{H}_6 + \text{OH}$	5.64E-18	1.44	10200.0
80	$\text{C}_2\text{H}_6 + \text{CH}_2 \Rightarrow \text{C}_3\text{H}_8$	3.74E-24	3.74	8520.0	151	$\text{H}_2\text{O} + \text{C}_2\text{H}_3 \Rightarrow \text{C}_2\text{H}_4 + \text{OH}$	8.02E-22	2.90	7480.0
81	$\text{C}_2\text{H}_4 + \text{C}_2\text{H}_2 \Rightarrow \text{C}_2\text{H}_3 + \text{C}_2\text{H}_3$	4.80E-12	0.00	0.0	152	$\text{H}_2\text{O} + \text{CH}_3 \Rightarrow \text{CH}_4 + \text{OH}$	8.02E-22	2.90	7480.0
82	$\text{C}_2\text{H}_4 + \text{H} \Rightarrow \text{C}_2\text{H}_5$	4.00E-11	0.00	34400.0	153	$\text{H}_2\text{O} + \text{CH}_2 \Rightarrow \text{CH}_3 + \text{OH}$	1.60E-16	0.00	0.0
83	$\text{C}_2\text{H}_4 + \text{OH} \Rightarrow \text{C}_2\text{H}_3 + \text{H}_2\text{O}$	4.20E-16	1.75	605.0	154	$\text{H}_2\text{O} + \text{CH}_3\text{O} \Rightarrow \text{CH}_3\text{OH} + \text{OH}$	5.79E-25	3.80	5780.0
84	$\text{C}_2\text{H}_4 + \text{H} \Rightarrow \text{C}_2\text{H}_3 + \text{H}_2$	2.61E-20	2.75	2100.0	155	$\text{H}_2\text{O} + \text{H} \Rightarrow \text{H}_2 + \text{OH}$	7.50E-16	1.60	9720.0
85	$\text{C}_2\text{H}_4 + \text{CH}_3 \Rightarrow \text{CH}_4 + \text{C}_2\text{H}_3$	2.20E-18	2.53	6160.0	156	$\text{H} + \text{H} \Rightarrow \text{H}_2$	1.80E-30	-1.00	0.0
86	$\text{C}_2\text{H}_2 + \text{H} \Rightarrow \text{C}_2\text{H}_3$	1.10E-23	3.70	4780.0	157	$\text{H} + \text{OH} \Rightarrow \text{H}_2\text{O}$	4.26E-11	0.23	-57.7
87	$\text{C}_2\text{H}_2 + \text{OH} \Rightarrow \text{CO} + \text{CH}_3$	9.13E-12	0.00	1220.0	158	$\text{H} + \text{OH} \Rightarrow \text{H}_2 + \text{O}$	8.10E-21	2.80	1950.0
88	$\text{CH}_3 + \text{CH}_2 \Rightarrow \text{C}_2\text{H}_4 + \text{H}$	8.04E-28	4.00	-1010.0	159	$\text{H} + \text{O} \Rightarrow \text{OH}$	1.30E-29	-1.00	0.0
89	$\text{C}_2\text{H}_2 + \text{CH}_3\text{O} \Rightarrow \text{CH}_2\text{O} + \text{C}_2\text{H}_3$	1.20E-12	0.00	4530.0	160	$\text{C}_3\text{H}_8 + \text{H} \Rightarrow \text{N}^* \text{C}_3\text{H}_7 + \text{H}_2$	2.20E-17	2.54	3400.0

90	$\text{HCO} + \text{HCO} \Rightarrow \text{CH}_2\text{O} + \text{CO}$	3.01E-11	0.00	0.0	161	$\text{C}_3\text{H}_8 + \text{H} \Rightarrow \text{I}^* \text{C}_3\text{H}_7 + \text{H}_2$	2.17E-18	2.40	2250.0
91	$\text{CH}_3\text{O} \Rightarrow \text{CH}_2\text{O} + \text{H}$	9.00E-11	0.00	6790.0	162	$\text{C}_3\text{H}_8 + \text{OH} \Rightarrow \text{N}^* \text{C}_3\text{H}_7 + \text{H}_2\text{O}$	3.79E-12	0.00	1310.0
92	$\text{CH}_2\text{O} \Rightarrow \text{CO} + \text{H}_2$	3.49E-09	0.00	17600.0	163	$\text{C}_3\text{H}_8 + \text{OH} \Rightarrow \text{I}^* \text{C}_3\text{H}_7 + \text{H}_2\text{O}$	4.83E-15	1.00	130.0
93	$\text{CH}_3\text{OH} \Rightarrow \text{CH}_3\text{O} + \text{H}$	1.19E+07	2.39	50200.0	164	$\text{C}_3\text{H}_8 + \text{O} \Rightarrow \text{N}^* \text{C}_3\text{H}_7 + \text{OH}$	3.20E-19	2.68	1870.0
94	$\text{C}_2\text{H}_5 + \text{C}_2\text{H}_5 \Rightarrow \text{C}_2\text{H}_6 + \text{C}_2\text{H}_4$	2.37E-12	0.00	0.0	165	$\text{C}_3\text{H}_8 + \text{O} \Rightarrow \text{I}^* \text{C}_3\text{H}_7 + \text{OH}$	7.93E-20	2.71	1060.0
95	$\text{C}_2\text{H}_5 + \text{C}_2\text{H}_4 \Rightarrow \text{C}_2\text{H}_6 + \text{C}_2\text{H}_3$	1.05E-21	3.13	9060.0	166	$\text{N}^* \text{C}_3\text{H}_7 + \text{H} \Rightarrow \text{C}_3\text{H}_6 + \text{H}_2$	3.01E-11	0.00	0.0
96	$\text{C}_2\text{H}_5 + \text{CH}_4 \Rightarrow \text{C}_2\text{H}_6 + \text{CH}_3$	1.43E-25	4.14	6320.0	167	$\text{I}^* \text{C}_3\text{H}_7 + \text{H} \Rightarrow \text{C}_3\text{H}_6 + \text{H}_2$	5.99E-12	0.00	0.0
97	$\text{C}_2\text{H}_5 + \text{CH}_3 \Rightarrow \text{CH}_4 + \text{C}_2\text{H}_4$	1.63E-12	0.00	0.0	168	$\text{I}^* \text{C}_3\text{H}_7 + \text{H} \Rightarrow \text{C}_3\text{H}_8$	3.32E-11	0.00	0.0
98	$\text{C}_2\text{H}_5 + \text{CH}_3 \Rightarrow \text{C}_3\text{H}_8$	5.60E-11	0.00	0.0	169	$\text{N}^* \text{C}_3\text{H}_7 + \text{OH} \Rightarrow \text{C}_3\text{H}_6 + \text{H}_2\text{O}$	4.00E-11	0.00	0.0
99	$\text{C}_2\text{H}_5 + \text{CH}_2 \Rightarrow \text{C}_2\text{H}_4 + \text{CH}_3$	3.01E-11	0.00	0.0	170	$\text{I}^* \text{C}_3\text{H}_7 + \text{OH} \Rightarrow \text{C}_3\text{H}_6 + \text{H}_2\text{O}$	4.00E-11	0.00	0.0
100	$\text{C}_2\text{H}_5 + \text{H} \Rightarrow \text{C}_2\text{H}_6$	9.04E-11	0.16	0.0	171	$\text{I}^* \text{C}_3\text{H}_7 + \text{CH}_3 \Rightarrow \text{C}_4\text{H}_{10}$	2.26E-09	-0.68	0.0
101	$\text{C}_2\text{H}_5 + \text{H} \Rightarrow \text{CH}_3 + \text{CH}_3$	5.99E-11	0.00	0.0	172	$\text{C}_3\text{H}_6 + \text{CH}_3 \Rightarrow \text{C}_4\text{H}_9$	3.15E-21	2.67	3450.0
102	$\text{C}_2\text{H}_5 + \text{H} \Rightarrow \text{C}_2\text{H}_4 + \text{H}_2$	3.01E-11	0.00	0.0	173	$\text{C}_4\text{H}_9 + \text{CH}_3 \Rightarrow \text{C}_5\text{H}_{12}$	3.19E-10	-0.32	0.0
103	$\text{C}_2\text{H}_5 + \text{OH} \Rightarrow \text{C}_2\text{H}_6 + \text{O}$	1.66E-40	8.80	250.0	174	$\text{C}_3\text{H}_6 + \text{H} \Rightarrow \text{I}^* \text{C}_3\text{H}_7$	7.06E-13	0.51	619.0
104	$\text{C}_2\text{H}_5 + \text{OH} \Rightarrow \text{C}_2\text{H}_4 + \text{H}_2\text{O}$	4.00E-11	0.00	0.0	175	$\text{C}_3\text{H}_6 + \text{H} \Rightarrow \text{N}^* \text{C}_3\text{H}_7$	4.15E-13	0.51	1320.0