

Appendix E

Reactions with larger hydrocarbons as reactants or products

This list is the part of the ComChem reaction network, containing all reactions related to the study performed in this work. Table 14.3 in section 14.2 gives detailed information for the main reactions including the references. The rate coefficient as used in the actual modeling are calculated by $k = A \left(\frac{T_e}{300}\right)^B \exp -\frac{C}{T_e}$ the standard Arrhenius form. For photolytic reaction the temperature dependence is negligible and therefore the A and B values are zero. For details see for example Schmidt *et al.* [1988].

The rates for the remaining reactions are a compilation of a number of sources: Huebner *et al.* [1992] (mainly for photolytic reactions), Schmidt *et al.* [1988], Boice *et al.* [1986] and the UMIST RATE99 database [Le Teuff *et al.*, 2000].

Reactants	Products	A	B	C	Reaction category
c2h6	--> c2h4 h2	3.67E-06	0.0000	0.0	Photodissoziation
c2h6	--> c2h5 h	3.28E-06	0.0000	0.0	Photodissoziation
c2h6	--> ch2 ch4	2.22E-06	0.0000	0.0	Photodissoziation
c2h6	--> ch3 ch3	8.80E-07	0.0000	0.0	Photodissoziation
c2h5	--> c2h2 h2 h	1.00E-06	0.0000	0.0	Photodissoziation
c2h4	--> c2h2 h h	2.30E-05	0.0000	0.0	Photodissoziation
c2h4	--> c2h2 h2	2.40E-05	0.0000	0.0	Photodissoziation
c2h4	--> ch2 ch2	6.00E-05	0.0000	0.0	Photodissoziation
c3h3	--> c3h2 h	1.82E-03	0.0000	0.0	Photodissoziation
c2h2	--> c2h h	1.02E-05	0.0000	0.0	Photodissoziation
c2h2	--> c2 h2	2.74E-06	0.0000	0.0	Photodissoziation
c2h	--> c2 h	3.00E-05	0.0000	0.0	Photodissoziation
c3h4	--> c3h2 h2	3.12E-05	0.0000	0.0	Photodissoziation
c3h4	--> c3h3 h	1.33E-04	0.0000	0.0	Photodissoziation
c3h2	--> c3 h2	9.50E-07	0.0000	0.0	Photodissoziation
ch4	--> ch3 h	2.64E-07	0.0000	0.0	Photodissoziation
ch4	--> ch2 h2	5.44E-06	0.0000	0.0	Photodissoziation
ch4	--> ch2 h h	2.14E-06	0.0000	0.0	Photodissoziation
ch4	--> ch h2 h	6.39E-07	0.0000	0.0	Photodissoziation
ch2	--> ch h	2.00E-05	0.0000	0.0	Photodissoziation
ch3oh	--> ch3 oh	5.58E-07	0.0000	0.0	Photodissoziation
ch3cn	--> ch3 cn	5.00E-05	0.0000	0.0	Photodissoziation
nh2ch3	--> nh2 ch3	3.00E-05	0.0000	0.0	Photodissoziation
c2h2	--> c2h2+ e	7.81E-07	0.0000	0.0	Photoionization

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c2h4	-->	c2h4+	e		5.80E-07	0.0000	0.0	Photoionization		
ch4	-->	ch4+	e		3.60E-07	0.0000	0.0	Photoionization		
ch2	-->	ch2+	e		1.00E-06	0.0000	0.0	Photoionization		
ch	-->	ch+	e		7.56E-07	0.0000	0.0	Photoionization		
c2h2	-->	c2h+	h	e	7.40E-08	0.0000	0.0	Photodissociative ionization		
c2h4	-->	c2h3+	h	e	2.27E-07	0.0000	0.0	Photodissociative ionization		
c2h4	-->	c2h2+	h2	e	2.02E-07	0.0000	0.0	Photodissociative ionization		
ch4	-->	ch3+	h	e	1.98E-07	0.0000	0.0	Photodissociative ionization		
ch4	-->	ch2+	h2	e	2.09E-08	0.0000	0.0	Photodissociative ionization		
ch4	-->	ch+	h2	h	4.16E-09	0.0000	0.0	Photodissociative ionization		
ch4	-->	h+	ch3	e	9.09E-09	0.0000	0.0	Photodissociative ionization		
c3h4	e	-->	c3	h2	h2	e	3.80E-08	0.5000	40618.0	Electron impact dissociation
c2h2	e	-->	c2h	h	e		1.90E-08	0.5000	62400.0	Electron impact dissociation
c2h2	e	-->	c2	h2	e		1.90E-08	0.5000	71700.0	Electron impact dissociation
ch4	e	-->	ch3	h	e		9.43E-10	0.5000	51989.0	Electron impact dissociation
c2h4	e	-->	c2h4+	e	e		3.88E-12	1.6200	77820.0	Electron impact ionization
ch4	e	-->	ch4+	e	e		3.75E-13	1.9100	65960.0	Electron impact ionization
c4h5+	e	-->	c3h4	ch			1.50E-07	-0.5000	0.0	Electron dissociative recombination
c4h2+	e	-->	c2h	c2h			2.50E-07	-0.5000	0.0	Electron dissociative recombination
c2h6+	e	-->	c2h4	h2			1.90E-06	-0.5000	0.0	Electron dissociative recombination
c2h5+	e	-->	c2h2	h2	h		1.90E-06	-0.5000	0.0	Electron dissociative recombination
c2h4+	e	-->	c2h2	h2			1.90E-06	-0.5000	0.0	Electron dissociative recombination
c2h3+	e	-->	c2h2	h			9.50E-07	-0.5000	0.0	Electron dissociative recombination
c2h2+	e	-->	c2h	h			2.95E-07	-0.5000	0.0	Electron dissociative recombination
c2h+	e	-->	c2	h			1.90E-06	-0.5000	0.0	Electron dissociative recombination
c3h5+	e	-->	c3h4	h			1.50E-07	-0.5000	0.0	Electron dissociative recombination
c3h+	e	-->	c3	h			1.90E-06	-0.5000	0.0	Electron dissociative recombination
ch5+	e	-->	ch4	h			7.00E-07	-0.5000	0.0	Electron dissociative recombination
ch4+	e	-->	ch3	h			1.20E-07	-0.5000	0.0	Electron dissociative recombination
ch4+	e	-->	ch2	h2			1.20E-07	-0.5000	0.0	Electron dissociative recombination
ch4+	e	-->	ch2	h	h		1.20E-07	-0.5000	0.0	Electron dissociative recombination
ch3+	e	-->	ch2	h			2.53E-07	-0.5000	0.0	Electron dissociative recombination
ch+	e	-->	c	h			1.00E-07	-0.5000	0.0	Electron dissociative recombination
c2h6+	c2h4	-->	c2h4+	c2h6			1.15E-09	0.0000	0.0	Positive ion charge interchange
c2h6+	nh3	-->	nh3+	c2h6			6.24E-10	0.0000	0.0	Positive ion charge interchange
c2h6+	ch3	-->	ch3+	c2h6			1.00E-09	0.0000	0.0	Positive ion charge interchange
c2h4+	nh3	-->	nh3+	c2h4			1.24E-10	0.0000	0.0	Positive ion charge interchange
c2h4+	ch3	-->	ch3+	c2h4			1.00E-09	0.0000	0.0	Positive ion charge interchange
c2h2+	c2h4	-->	c2h4+	c2h2			4.01E-10	0.0000	0.0	Positive ion charge interchange
c2h2+	c3h4	-->	c3h4+	c2h2			5.00E-10	0.0000	0.0	Positive ion charge interchange
c2h2+	nh3	-->	nh3+	c2h2			2.14E-09	0.0000	0.0	Positive ion charge interchange
c2h2+	h2co	-->	h2co+	c2h2			8.60E-10	0.0000	0.0	Positive ion charge interchange
c2h2+	h2s	-->	h2s+	c2h2			2.20E-09	0.0000	0.0	Positive ion charge interchange
c2h2+	na	-->	na+	c2h2			2.70E-09	0.0000	0.0	Positive ion charge interchange
c2h+	s	-->	s+	c2h			1.20E-09	0.0000	0.0	Positive ion charge interchange
ch4+	c2h2	-->	c2h2+	ch4			1.13E-09	0.0000	0.0	Positive ion charge interchange
ch4+	c2h4	-->	c2h4+	ch4			1.38E-09	0.0000	0.0	Positive ion charge interchange
ch4+	nh3	-->	nh3+	ch4			1.60E-09	0.0000	0.0	Positive ion charge interchange
ch4+	o2	-->	o2+	ch4			4.40E-10	0.0000	0.0	Positive ion charge interchange
ch4+	c2h2	-->	c2h2+	ch4			1.13E-09	0.0000	0.0	Positive ion charge interchange
ch4+	c2h4	-->	c2h4+	ch4			1.38E-09	0.0000	0.0	Positive ion charge interchange
h2+	c2h6	-->	c2h6+	h2			2.94E-10	0.0000	0.0	Positive ion charge interchange
h2+	c2h4	-->	c2h4+	h2			2.20E-09	0.0000	0.0	Positive ion charge interchange
h2+	c2h2	-->	c2h2+	h2			4.82E-09	0.0000	0.0	Positive ion charge interchange
h2+	ch4	-->	ch4+	h2			1.41E-09	0.0000	0.0	Positive ion charge interchange
h+	c3h4	-->	c3h4+	h			2.00E-09	0.0000	0.0	Positive ion charge interchange
h+	ch4	-->	ch4+	h			1.52E-09	0.0000	0.0	Positive ion charge interchange

c+	c3h4	-->	c3h4+	c	5.70E-10	0.0000	0.0	Positive ion charge interchange
n2+	ch4	-->	ch4+	n2	1.65E-10	0.0000	0.0	Positive ion charge interchange
oh+	ch4	-->	ch4+	oh	9.68E-10	0.0000	0.0	Positive ion charge interchange
n2+	ch4	-->	ch4+	n2	1.65E-10	0.0000	0.0	Positive ion charge interchange
co+	ch4	-->	ch4+	co	1.16E-09	0.0000	0.0	Positive ion charge interchange
co2+	ch4	-->	ch4+	co2	8.80E-10	0.0000	0.0	Positive ion charge interchange
c+	ch	-->	ch+	c	1.00E-09	0.0000	0.0	Positive ion charge interchange
c3h5+	c6h6	-->	c6h7+	c3h4	1.15E-10	0.0000	0.0	Positive ion-atom interchange
c3h4+	c3h4	-->	c6h7+	h	7.50E-10	0.0000	0.0	Positive ion-atom interchange
c3h4	c4h+	-->	c7h4+	h	1.20E-09	0.0000	0.0	Positive ion-atom interchange
c3h4	c4h2+	-->	c7h4+	h2	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c3h4	c4h3+	-->	c7h5+	h2	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c3h4	c5h2+	-->	c8h4+	h2	1.10E-09	0.0000	0.0	Positive ion-atom interchange
c3h4	c6h2+	-->	c9h4+	h2	1.10E-09	0.0000	0.0	Positive ion-atom interchange
c3h3+	c3h4	-->	c6h5+	h2	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c3h2+	c3h4	-->	h2c3h+c3h3		3.00E-10	0.0000	0.0	Positive ion-atom interchange
c3h2+	c3h4	-->	c6h4+	h2	3.00E-10	0.0000	0.0	Positive ion-atom interchange
c3+	h2	-->	c3h+	h	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h6+	c2h6	-->	c3h8+	ch4	7.98E-12	0.0000	0.0	Positive ion-atom interchange
c2h6+	c2h2	-->	c3h5+	ch3	8.19E-10	0.0000	0.0	Positive ion-atom interchange
c2h6+	c2h2	-->	c4h7+	h	1.29E-10	0.0000	0.0	Positive ion-atom interchange
c2h6+	c2h2	-->	c2h5+	c2h3	2.22E-10	0.0000	0.0	Positive ion-atom interchange
c2h6+	h2o	-->	h3o+	c2h5	2.95E-09	0.0000	0.0	Positive ion-atom interchange
c2h6+	nh3	-->	nh4+	c2h5	1.61E-09	0.0000	0.0	Positive ion-atom interchange
c2h6+	h2co	-->	ch2oh+c2h5		1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h6+	hcn	-->	h2cn+	c2h5	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h5+	c2h2	-->	c3h3+	ch4	6.80E-11	0.0000	0.0	Positive ion-atom interchange
c2h5+	c2h2	-->	c4h5+	h2	1.22E-10	0.0000	0.0	Positive ion-atom interchange
c2h5+	c2h4	-->	c3h5+	ch4	3.90E-10	0.0000	0.0	Positive ion-atom interchange
c2h5+	h2o	-->	h3o+	c2h4	7.50E-10	0.0000	0.0	Positive ion-atom interchange
c2h5+	nh3	-->	nh4+	c2h4	2.18E-09	0.0000	0.0	Positive ion-atom interchange
c2h5+	h2co	-->	ch2oh+c2h4		1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h5+	hcn	-->	h2cn+	c2h4	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h5+	ch3	-->	c2h4+	ch4	5.00E-10	0.0000	0.0	Positive ion-atom interchange
c2h4+	c3h4	-->	c4h5+	ch3	8.00E-10	0.0000	0.0	Positive ion-atom interchange
c2h4+	c2h4	-->	c3h5+	ch3	7.28E-10	0.0000	0.0	Positive ion-atom interchange
c2h4+	c2h4	-->	c4h7+	h	7.20E-11	0.0000	0.0	Positive ion-atom interchange
c2h4+	c2h2	-->	c3h3+	ch3	6.32E-10	0.0000	0.0	Positive ion-atom interchange
c2h4+	c2h2	-->	c4h5+	h	1.58E-10	0.0000	0.0	Positive ion-atom interchange
c2h4+	nh3	-->	nh4+	c2h3	1.94E-09	0.0000	0.0	Positive ion-atom interchange
c2h3+	c3h4	-->	c3h5+	c2h2	5.00E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	c3h4	-->	c5h5+	h2	5.00E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	c2h6	-->	c2h5+	c2h4	2.91E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	c2h6	-->	c3h5+	ch4	2.48E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	c2h6	-->	c4h7+	h2	8.10E-11	0.0000	0.0	Positive ion-atom interchange
c2h3+	c2h4	-->	c2h5+	c2h2	9.30E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	c2h2	-->	c4h3+	h2	2.50E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	h2o	-->	h3o+	c2h2	1.11E-09	0.0000	0.0	Positive ion-atom interchange
c2h3+	nh3	-->	nh4+	c2h2	2.48E-09	0.0000	0.0	Positive ion-atom interchange
c2h3+	h2co	-->	ch2oh+c2h2		1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h3+	hcn	-->	h2cn+	c2h2	1.00E-09	0.0000	0.0	Positive ion-atom interchange
c2h3+	h2s	-->	h3s+	c2h2	8.40E-10	0.0000	0.0	Positive ion-atom interchange
c2h3+	ch4	-->	c3h5+	h2	2.20E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c3h4	-->	c5h4+	h2	5.00E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c3h4	-->	c5h5+	h	5.00E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c2h2	-->	c4h2+	h2	5.22E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c2h2	-->	c4h3+	h	8.88E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c2h6	-->	c2h4+	c2h4	2.63E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c2h6	-->	c2h5+	c2h3	1.31E-10	0.0000	0.0	Positive ion-atom interchange
c2h2+	c2h6	-->	c3h3+	ch3	8.80E-11	0.0000	0.0	Positive ion-atom interchange
c2h2+	c2h6	-->	c3h5+	ch3	7.88E-10	0.0000	0.0	Positive ion-atom interchange

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c2h2+	c2h6	-->	c4h5+	h2	h	7.30E-11	0.0000	0.0	Positive	ion-atom	interchange
c2h2+	c2h6	-->	c4h7+	h		1.31E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h2+	c2h4	-->	c3h3+	ch3		5.07E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h2+	c2h4	-->	c4h5+	h		2.71E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h2+	h2co	-->	hco+	c2h3		5.38E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h2+	ch4	-->	c3h4+	h2		1.76E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h2+	ch4	-->	c3h5+	h		6.64E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h+	ch4	-->	c2h2+	ch3		3.74E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h+	ch4	-->	c3h3+	h2		3.74E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h+	ch4	-->	c3h4+	h		1.32E-10	0.0000	0.0	Positive	ion-atom	interchange
c2h+	nh3	-->	nh4+	c2		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange
c2h+	h2co	-->	ch2oh+	c2		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange
c2h+	hcn	-->	h2cn+	c2		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange
c2h+	h2	-->	c2h2+	h		7.80E-10	0.0000	0.0	Positive	ion-atom	interchange
c2+	ch4	-->	c3h2+	h2		5.74E-10	0.0000	0.0	Positive	ion-atom	interchange
c2+	ch4	-->	c2h+	ch3		2.38E-10	0.0000	0.0	Positive	ion-atom	interchange
c2+	ch4	-->	c3h3+	h		2.10E-10	0.0000	0.0	Positive	ion-atom	interchange
c2+	ch4	-->	c3h+	h2	h	1.96E-10	0.0000	0.0	Positive	ion-atom	interchange
c2+	ch4	-->	c2h2+	ch2		1.82E-10	0.0000	0.0	Positive	ion-atom	interchange
c2+	h2	-->	c2h+	h		1.12E-09	0.0000	0.0	Positive	ion-atom	interchange
c+	c3h4	-->	c2h2+	c2h2		1.90E-10	0.0000	0.0	Positive	ion-atom	interchange
c+	c3h4	-->	h2c3h+	ch		3.80E-10	0.0000	0.0	Positive	ion-atom	interchange
c+	c3h4	-->	c2h3+	c2h		1.90E-10	0.0000	0.0	Positive	ion-atom	interchange
c+	c3h4	-->	c4h2+	h2		5.70E-10	0.0000	0.0	Positive	ion-atom	interchange
c+	ch4	-->	c2h3+	h		1.03E-09	0.0000	0.0	Positive	ion-atom	interchange
c+	ch4	-->	c2h2+	h2		4.20E-10	0.0000	0.0	Positive	ion-atom	interchange
c+	ch2	-->	c2h+	h		2.00E-09	0.0000	0.0	Positive	ion-atom	interchange
c+	ch3	-->	c2h2+	h		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange
c+	c2h	-->	c3+	h		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange
ch5+	ch3	-->	c2h6+	h2		5.00E-10	0.0000	0.0	Positive	ion-atom	interchange
ch4+	c2h2	-->	c2h3+	ch3		1.24E-09	0.0000	0.0	Positive	ion-atom	interchange
ch4+	c2h2	-->	c3h3+	h2	h	1.51E-10	0.0000	0.0	Positive	ion-atom	interchange
ch4+	c2h4	-->	c2h5+	ch3		4.23E-10	0.0000	0.0	Positive	ion-atom	interchange
ch4+	c2h4	-->	c3h5+	h2	h	5.50E-11	0.0000	0.0	Positive	ion-atom	interchange
ch4+	c2h6	-->	c2h4+	ch4	h2	1.91E-09	0.0000	0.0	Positive	ion-atom	interchange
ch4+	ch4	-->	ch5+	ch3		1.15E-09	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c2h2	-->	c3h3+	h2		1.15E-09	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c2h4	-->	c2h3+	ch4		3.50E-10	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c2h4	-->	c3h3+	h2	h2	4.60E-11	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c2h4	-->	c3h5+	h2		5.24E-10	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c2h6	-->	c2h5+	ch4		1.48E-09	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c2h6	-->	c3h5+	h2	h2	1.57E-10	0.0000	0.0	Positive	ion-atom	interchange
ch3+	ch4	-->	c2h5+	h2		9.60E-10	0.0000	0.0	Positive	ion-atom	interchange
ch3+	nh3	-->	nh4+	ch2		3.20E-10	0.0000	0.0	Positive	ion-atom	interchange
ch3+	h2co	-->	hco+	ch4		1.60E-09	0.0000	0.0	Positive	ion-atom	interchange
ch3+	c	-->	c2h+	h2		1.20E-09	0.0000	0.0	Positive	ion-atom	interchange
ch2+	ch4	-->	c2h5+	h		2.88E-10	0.0000	0.0	Positive	ion-atom	interchange
ch2+	ch4	-->	c2h4+	h2		5.04E-10	0.0000	0.0	Positive	ion-atom	interchange
ch2+	ch4	-->	c2h3+	h2	h	2.64E-10	0.0000	0.0	Positive	ion-atom	interchange
ch2+	ch4	-->	c2h2+	h2	h2	1.44E-10	0.0000	0.0	Positive	ion-atom	interchange
ch+	h2o	-->	hco+	h2		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange
ch+	h2o	-->	h2co+	h		2.90E-10	0.0000	0.0	Positive	ion-atom	interchange
ch+	h2o	-->	h3o+	c		2.90E-10	0.0000	0.0	Positive	ion-atom	interchange
ch+	co2	-->	hco+	co		1.60E-09	0.0000	0.0	Positive	ion-atom	interchange
ch+	nh3	-->	h2cn+	h2		1.84E-09	0.0000	0.0	Positive	ion-atom	interchange
ch+	nh3	-->	nh4+	c		4.00E-10	0.0000	0.0	Positive	ion-atom	interchange
ch+	ch4	-->	c2h4+	h		7.70E-11	0.0000	0.0	Positive	ion-atom	interchange
ch+	ch4	-->	c2h3+	h2		1.06E-09	0.0000	0.0	Positive	ion-atom	interchange
ch+	ch4	-->	c2h2+	h2	h	1.55E-10	0.0000	0.0	Positive	ion-atom	interchange
ch+	h2co	-->	ch2oh+	c		9.60E-10	0.0000	0.0	Positive	ion-atom	interchange
ch+	hcn	-->	h2cn+	c		1.80E-09	0.0000	0.0	Positive	ion-atom	interchange
ch+	c2h2	-->	c2h3+	c		1.00E-09	0.0000	0.0	Positive	ion-atom	interchange

ch+	c2h4	-->	c2h5+ c	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
ch+	hco	-->	h2co+ c	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
ch+	nh2	-->	nh3+ c	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
ch+	h2	-->	ch2+ h	1.01E-09	0.0000	0.0	Positive ion-atom interchange	
h3o+	c2h3	-->	c2h4+ h2o	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
h3o+	c3h4	-->	c3h5+ h2o	2.00E-09	0.0000	0.0	Positive ion-atom interchange	
h2o+	c2h2	-->	c2h3+ oh	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
h2o+	c2h4	-->	c2h5+ oh	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
h2o+	c2	-->	c2h+ oh	4.70E-10	0.0000	0.0	Positive ion-atom interchange	
oh+	c2h5	-->	c2h6+ o	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h2	-->	c2h3+ h	4.77E-10	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h4	-->	c2h3+ h2 h	1.81E-09	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h4	-->	c2h2+ h2 h2	8.80E-10	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h6	-->	c2h5+ h2 h	1.37E-09	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h6	-->	c2h4+ h2 h2	2.35E-09	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h6	-->	c2h3+ h2 h2 h	6.86E-10	0.0000	0.0	Positive ion-atom interchange	
h2+	c2h6	-->	c2h2+ h2 h2 h2	1.96E-10	0.0000	0.0	Positive ion-atom interchange	
h2+	ch4	-->	ch5+ h	1.14E-10	0.0000	0.0	Positive ion-atom interchange	
h2+	ch4	-->	ch3+ h2 h	2.28E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	c2h2	-->	c2h3+ h2	3.50E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	c2h4	-->	c2h5+ h2	1.44E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	c2h4	-->	c2h3+ h2 h2	2.16E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	c2h6	-->	c2h5+ h2 h2	3.40E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	c3h4	-->	h2c3h+h2 h2	2.25E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	c3h4	-->	c3h5+ h2	6.75E-10	0.0000	0.0	Positive ion-atom interchange	
h3+	c	-->	ch+ h2	2.00E-09	0.0000	0.0	Positive ion-atom interchange	
h3+	ch4	-->	ch5+ h2	2.40E-09	0.0000	0.0	Positive ion-atom interchange	
h2+	c	-->	ch+ h	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
h+	ch4	-->	ch3+ h2	2.28E-09	0.0000	0.0	Positive ion-atom interchange	
h2co+	c2h4	-->	c2h5+ hco	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
h2co+	c2	-->	c2h+ hco	8.20E-10	0.0000	0.0	Positive ion-atom interchange	
hco+	c2h2	-->	c2h3+ co	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
hco+	c2h4	-->	c2h5+ co	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
hco+	c3h4	-->	c3h5+ co	1.40E-09	0.0000	0.0	Positive ion-atom interchange	
hco+	c2h	-->	c2h2+ co	1.00E-09	0.0000	0.0	Positive ion-atom interchange	
c2h3	h2	-->	c2h4 h	5.00E-12	0.0000	3200.0	Neutral rearrangement	
c2h3	h	-->	c2h2 h2	7.00E-12	0.0000	0.0	Neutral rearrangement	
ch2	ch2	-->	c2h2 h2	5.30E-11	0.0000	0.0	Neutral rearrangement	
ch2	ch3	-->	c2h4 h	5.00E-11	0.0000	0.0	Neutral rearrangement	
ch	ch4	-->	c2h4 h	2.50E-12	0.0000	0.0	Neutral rearrangement	
c	c3h4	-->	c4h2 h2	4.00E-10	0.0000	0.0	Neutral rearrangement	
c(1d)	ch4	-->	c2h2 h2	3.20E-11	0.0000	0.0	Neutral rearrangement	
ch2	n	-->	hcn h	1.00E-11	0.5000	0.0	Neutral rearrangement	
o(1d)	ch4	-->	ch3 oh	1.20E-10	0.0000	0.0	Neutral rearrangement	
c(1d)	ch4	-->	c2h2 h2	3.20E-11	0.0000	0.0	Neutral rearrangement	
c2h2	h	m	-->	c2h3 m	2.50E-30	0.0000	0.0	3-Body neutral recombination
ch3	ch3	m	-->	c2h6 m	6.00E-29	0.0000	0.0	3-Body neutral recombination
ch3	h	m	-->	ch4 m	8.50E-29	0.0000	0.0	3-Body neutral recombination
ch3	ch3	m	-->	c2h6 m	6.00E-29	0.0000	0.0	3-Body neutral recombination
c2h4+	ch4	m	-->	c3h8+ m	1.00E-29	0.0000	0.0	3-Body positive-neutral association
ch+	e	-->	ch	1.05E-10	-0.7000	0.0	Radiative recombination	
ch4	h2	-->	ch3 h h2	3.30E-07	0.0000	44035.0	Hydrogen impact dissociation	
ch4	h	-->	ch3 h h	3.30E-07	0.0000	44035.0	Hydrogen impact dissociation	