

Table S1 Second-order rate coefficients obtained for the reactions of $^1\text{C}_2$ and $^3\text{C}_2$ with acetylene and methylacetylene. The range of excess coreagent concentrations used are also shown.

T/K	Acetylene C_2H_2			Methylacetylene CH_3CCH		
	$^1\text{C}_2$		$^3\text{C}_2$	$^1\text{C}_2$		$^3\text{C}_2$
	$[\text{C}_2\text{H}_2] / 10^{14}$ molecule cm^{-3}	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$	$[\text{C}_3\text{H}_4] / 10^{14}$ molecule cm^{-3}	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$
77	0.2 - 1.5	4.2 ± 0.4^a	2.3 ± 0.2	0.2 - 1.1	4.5 ± 0.5	4.4 ± 0.5
128	0.2 - 3.2	4.2 ± 0.5	1.5 ± 0.2	0.3 - 1.7	4.9 ± 0.5	3.7 ± 0.4
170	0.4 - 2.3	3.9 ± 0.4	1.1 ± 0.1	0.3 - 1.6	4.2 ± 0.4	3.0 ± 0.3
220	0.3 - 2.3	3.8 ± 0.4	1.1 ± 0.1	0.3 - 1.3	4.1 ± 0.5	2.9 ± 0.3
296	0.3 - 1.6	4.1 ± 0.4	1.1 ± 0.1	0.4 - 1.2	4.9 ± 0.5	3.1 ± 0.3

^a Uncertainties are cited at the level of a single standard deviation and contain a contribution from the estimated systematic errors

Table S2 Second-order rate coefficients obtained for the reactions of $^1\text{C}_2$ and $^3\text{C}_2$ with allene and propene. The range of excess coreagent concentrations used are also shown.

T/K	Allene H_2CCCH_2			Propene H_3CCHCH_2		
	$^1\text{C}_2$		$^3\text{C}_2$	$^1\text{C}_2$		$^3\text{C}_2$
	$[\text{C}_3\text{H}_4] / 10^{14}$ molecule cm^{-3}	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$	$[\text{C}_3\text{H}_6] / 10^{14}$ molecule cm^{-3}	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$	$k_{2\text{nd}}/10^{-10} \text{ cm}^3$ molecule $^{-1} \text{ s}^{-1}$
77	0.2 - 1.3	4.7 ± 0.5^a	3.4 ± 0.3	0.2 - 1.3	4.5 ± 0.5	3.6 ± 0.4
128	0.2 - 1.5	4.8 ± 0.5	2.7 ± 0.3	0.2 - 1.5	4.5 ± 0.6	2.8 ± 0.3
170	0.3 - 1.4	4.9 ± 0.5	2.9 ± 0.3	0.3 - 1.4	4.4 ± 0.6	2.7 ± 0.3
220	0.1 - 1.3	4.9 ± 0.5	2.5 ± 0.3	0.1 - 1.3	3.8 ± 0.5	2.6 ± 0.3
296	0.2 - 1.2	5.0 ± 0.5	2.7 ± 0.3	0.2 - 1.2	4.0 ± 0.5	2.3 ± 0.3

^a Uncertainties are cited at the level of a single standard deviation and contain a contribution from the estimated systematic errors