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$$C_4 + CRPHOT \rightarrow C_3 + C \quad (1)$$
$$\rightarrow C_2 + C_2 \quad (2)$$
$$\rightarrow C_2 + C + C \quad (3)$$

*Thermodynamic Data*

Dissociation Energy (1) = 465 kJ $mol^{-1}$ = 4.82 eV

Dissociation Energy (2) = 588 kJ $mol^{-1}$ = 6.09 eV

Dissociation Energy (3) = 1166 kJ $mol^{-1}$ = 12.08 eV

Ionisation Potential = 1206 kJ $mol^{-1}$ = 12.50 eV

Calculated DE from Diaz-Tendero et al (2006) (and good agreement with measurements of Gingerich et al (1994) within 0.3 eV estimated error bars); IP (adiabatic) from Van Orden 1998 (estimated error bar: 0.3 eV).

**Rate Coefficient Data**

| $k$ / molecule$^{-1}$ s$^{-1}$ | $T$ / K | Reference | Comments |
|---|---|---|---|
| *Rate Coefficient Measurement* | | | |
| None | | | |
| *Reviews and Evaluations* | | | |
| $1.0 \times 10^3 \times \zeta$ | | OSU09 website | (a) |
| $1.0 \times 10^3 \times \zeta$ | 10-41000 | UMIST06 database | (a) |
| *Branching Fraction Measurement* | | | |
| (1) = 0.77 (±0.04) | | Chabot 2006, 2010 | (c) |
| (2) = 0.23 (±0.02) | | | |
| *Branching fraction Reviews and Evaluations* | | | |
| (1) = 1.0; (2) = 0.0 | | OSU09 website | (b) |
| (1) = (2) = 0.5 | 10-41000 | UMIST06 database | |

## Comments

(a) In OSU database the sum of CRPHOT and CR is considered. The last one is expected to be negligible as compared to CRPHOT. Rate has been taken identical to the estimated rate of Gredel (1989) for the $C_3$.
Lognormal factor 1.25 of accuracy is reported.

(b) Branching fractions reported in OSU databases are those given in Bettens & Herbst (1995) although no details on how these were estimated for the CRPHOT process were found anywhere in the literature. UMIST estimations for branching fractions are identical to those used for Dissociative Recombination (Herbst 1989).

(c) Measurements have been performed with high velocity collision experiments on hot (3000°K) $C_4$ clusters produced by a sputtering source. Results have been interpreted satisfactorily within statistical fragmentation behaviour (Martinet 2004). Derivation of these experimental results in astrochemical context assumes that statistical fragmentation occurs under CRPHOT process (Chabot 2010). Channel (3) is not relevant because it requires CRPHOT energies above or very close to the end of the emission spectrum of $H_2$ (Gredel 1989).

## Preferred Values

*Rate constant:*
$k = 1.0 \times 10^3 \times \zeta$ molecule$^{-1}$ s$^{-1}$

*Reliability of rate constant:*
Factor 2

*Recommended Branching Fractions:*
(1)=0.75
(2)=0.25

*Reliability of Branching Fractions:*
±0.1 (uniform)

## References


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