



**HAL**  
open science

## Dissociation of doubly charged Coronene as a function of internal energy

Richard Bredy, C. Ortega, Min Ji, L. Chen, Jérôme Bernard, Serge Martin

### ► To cite this version:

Richard Bredy, C. Ortega, Min Ji, L. Chen, Jérôme Bernard, et al.. Dissociation of doubly charged Coronene as a function of internal energy. *Journal of Physics: Conference Series*, 2015, 635 (3), pp.032052. 10.1088/1742-6596/635/3/032052 . hal-02308176

**HAL Id: hal-02308176**

**<https://univ-lyon1.hal.science/hal-02308176>**

Submitted on 3 Feb 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

PAPER • OPEN ACCESS

## Dissociation of doubly charged Coronene as a function of internal energy

To cite this article: R Brédy *et al* 2015 *J. Phys.: Conf. Ser.* **635** 032052

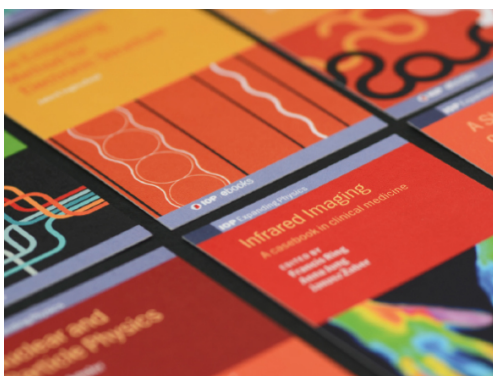
View the [article online](#) for updates and enhancements.

### Related content

- [Hypersonic Meteoroid Entry Physics: Non-empirical analytical model of non-equilibrium dissociation in high-temperature air](#)  
G Colonna, M Capitelli and A Laricchiuta
- [Carbon/hydrogen clusters \[C<sub>n</sub>H<sub>x</sub><sup>+</sup>\] formation from laser irradiation of coronene](#)  
F Betancourt, J C Poveda, I Alvarez et al.
- [Quarkonium dissociation in an anisotropic QGP](#)  
Lata Thakur and Binoy Krishna Patra

### Recent citations

- [Photo-stability of Super-hydrogenated PAHs Determined by Action Spectroscopy Experiments](#)  
M. Wolf *et al.*



**IOP | ebooks™**

Bringing together innovative digital publishing with leading authors from the global scientific community.

Start exploring the collection—download the first chapter of every title for free.

## Dissociation of doubly charged Coronene as a function of internal energy

R. Brédy<sup>\*1</sup>, C. Ortéga\*, M. Ji\*, L. Chen\*, J. Bernard\* and S. Martin\*

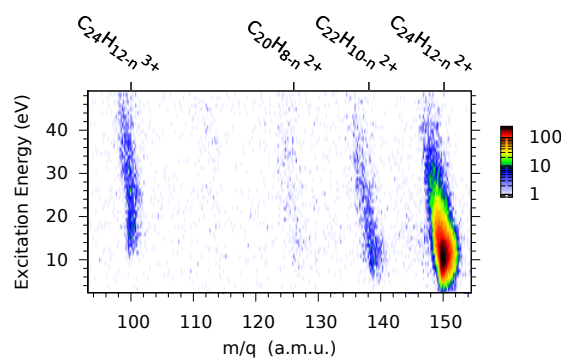
\* Institut Lumière Matière, UMR5306 Université Lyon 1-CNRS, Université de Lyon 69622 Villeurbanne cedex, France

**Synopsis** We report on the dissociation of doubly charged Coronene ( $C_{24}H_{12}^{2+}$ ) as a function of internal energy. The mass spectra were obtained for internal energy measured up to 50 eV using the CIDEC method in collisions with  $F^+$  and  $H^+$  at 3 keV. The dehydrogenation processes of the molecule were observed over this large range of energy as well as the other weaker channels, loss of  $C_2H_n$ ,  $2C_2H_n$  and ionization. The branching ratios for the fragments  $C_{24}H_{12-n}^{2+}$ ,  $C_{22}H_{12-n}^{2+}$ ,  $C_{20}H_{12-n}^{2+}$  and  $C_{24}H_{12-n}^{3+}$  ( $n=0-6$ ) were measured.

Polycyclic aromatic hydrocarbons (PAHs) are extensively studied since many decades due to their relevance e.g. in astrophysics in the attempt of explaining the observation of the unidentified infrared bands. The important role of PAHs as catalyst in the formation of  $H_2$  in the photodissociation regions of the interstellar medium has also been suggested. The numerous photodissociation and collision experiments as well as theoretical investigations have shown that the main dissociation channels are the loss of  $H$ ,  $H_2$  and small hydrocarbon molecules such as  $C_2H_2$ . With a highly symmetric structure coronene ( $C_{24}H_{12}$ ) is considered as a model PAH system. The emission of an even number of  $H$  atoms is in general favored but the related process whether the direct  $H_2$  emission or the sequential  $H$  loss is still under debate [1].

In this work, the fragmentation of coronene induced by collision with  $F^+$  and  $H^+$  at 3 keV is investigated using the CIDEC method [2]. In this method the excitation energy of the doubly charged coronene ion is determined by measuring the kinetic energy loss of the negative scattered ion formed in the collision  $F^+ + C_{24}H_{12} \rightarrow F^- + C_{24}H_{12}^{2+}$ . The measurements are performed in coincidence with time-of-flight mass spectrometry leading to mass spectra resolved in internal energy of the  $C_{24}H_{12}^{2+}$  parent ion (Figure 1). As expected the dehydrogenation of coronene (loss of  $H$ ,  $H_2$ ) is the dominant process. Internal energy up to 50 eV have been measured. Over this wide range of energy the branching ratios for the fragments  $C_{24}H_{12-n}^{2+}$ ,  $C_{22}H_{12-n}^{2+}$  ( $C_2H_n$  loss),  $C_{20}H_{12-n}^{2+}$  ( $2C_2H_n$  loss) and  $C_{24}H_{12-n}^{3+}$  ( $n=0-6$ ) were measured to be about 90%, 4%, 1% and 5% respectively. These branching ratios are also presented in table 1 as a function of selected energy ranges. Stable

$C_{24}H_{12}^{2+}$  parent ions are observed with internal energy of about 10 eV but it is noticeable that a small fraction of  $C_{22}H_{12-n}^{2+}$  fragment is also observed at this energy. This may indicate a strong competition between the loss of  $H$  and  $C_2H_2$  at low excitation energies while  $H/H_2$  loss dominate at higher excitation energy as already observed for doubly charged anthracene ions [3].



**Figure 1.** Excitation energy of  $C_{24}H_{12}^{2+}$  as a function of the mass spectrum.  $C_{24}H_{12}^{2+}$  are formed in 3 keV  $F^+ + C_{24}H_{12} \rightarrow F^- + C_{24}H_{12}^{2+}$  collisions.

**Table 1.** Branching ratios (%) as a function of the excitation energy of  $C_{24}H_{12}^{2+}$  parent ion. Energy range in eV.

	1.5-10	10-19	19-27	27-49
$C_{24}H_{12-n}^{2+}$	97.5	94.5	80	50
$C_{22}H_{12-n}^{2+}$	2.5	3	7	14
$C_{20}H_{12-n}^{2+}$		< 1	2	7
$C_{24}H_{12-n}^{3+}$		2	11	29

### References

- [1] C. Paris *et al.* 2014 *J. Chem. Phys.* **140** 0204307
- [2] L. Chen *et al.* 2007 *Phys. Rev. Lett.* **98** 193401
- [3] S. Martin *et al.* 2012 *Phys. Rev.* **A85** 052715

<sup>1</sup>E-mail: richard.bredy@univ-lyon1.fr

