Fragmentation of hydrocarbons by collision. AGAT@ANDROMEDE.

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Synopsis We are studying small hydrocarbons produced in high velocity (3.4 a.u.) collision between CH_y^+ cations and He atoms. During the collision those hydrocarbons gain some energy and release this energy doing fragmentation. Thanks to the detector AGAT we have been able to measure fragmentation branching ratios for CH_y^{q+} (y=2-4, q=0-3). We also constructed semi-empirical breakdown curves for CH_y^{q+} using these experimental branching ratios.

The classical scenario of the main hydrocarbon gas phase synthesis in astrochemistry, starts with the reaction of C^+ ions with hydrogen atom or molecule. Then, the formed $CH_y^{(+)}$ species can react with another C atom or ion, and give heavier hydrocarbon species. Since $CH_y^{(+)}$ molecules are the mother of all the other hydrocarbons, reliable simulations in this field need precise both total reaction rates and branching ratio (BR). To document all the BRs, whatever the chemical or physical process at play, we construct, on both experimental and theoretical grounds, semi empirical Break Down Curve (BDC) [1]. These curves are internal energy dependent branching ratio as illustrated in Fig. 1 in case of CH_2 molecule.

The experiment was done using the AGAT silicon multidetector and the ANDROMEDE accelerator. CH_y^+ molecules produced at high velocity are collided with He atom at rest in the lab. Thanks to the experimental developments, all fragments, neutral or charged, are separately identified, allowing to resolve all fragmentation channels. Therefore we have been able to measure fragmentation branching ratio for CH_y^{q+} (n=2-4, q=0-3). In addition, using a CCD camera to detect neutral fragments [2], kinetic energy distribution (KED) of neutral fragments in each fragmentation channel is also measured.

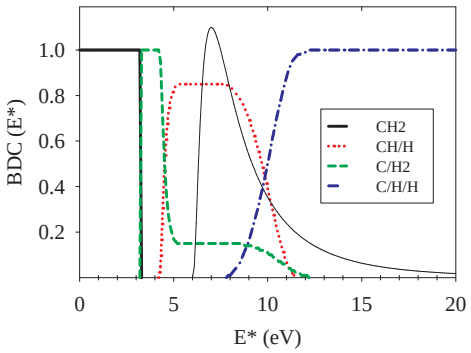

Figure 1. Semi empirical break down curve of the CH_2 molecule.

The semi empirical BDCs construct using these BRs and KEDs and with theoretical dissociation energies of [3], are found in good agreement with existing photodissociation, dissociative recombination and electron impact experimental BRs.

References

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