Positron and Electron Total Cross Sections for C_3H_6 and C_3F_6 Molecules: the Fluorination Effect

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Pure hydrocarbons play an important role for plasma diagnostics as impurities in Tokamak fusion divertor, as seed gases for production of radicals and ions in low temperature plasma processing [1]. On the other hand, fluorine-substituted hydrocarbons, the so-called perfluorocarbons (PFCs), are not the less important also as they play significant roles as reactive agents in plasma-assisted fabrication processes [2]. The hexafluoropropene ($F_3C{-}CH{=}CF_2$) molecule offers an opportunity for studying the effects of fluorine atom substitution on the electronic structure and spectra of propene ($H_3C{-}CH{=}CH_2$).

In this work, total cross sections (TCSs) for the two molecule were measured for 0.4-1000 eV electron and 0.2-1000 eV positron impact using a linear time-of-flight apparatus [3]. The Continuum Multiple Scattering (CMS) [4] calculations have also been performed to provide theoretical rationales to the observed features in the electron impact TCSs. Some of the results obtained are shown in Fig. 1. Among other features, the fluorination effect shows itself in the positron C_3H_6 TCSs being greater than the C_3F_6 results in the range 1.5 – 25 eV, with the difference averaging 30% in the peak region. Besides, these TCSs have a broad peak spanning the region 4 – 40 eV for C_3H_6, split into two by a minimum at about 10 eV, while this peak in C_3F_6 spans the even broader region of 4 – 200 eV and is split into three regions by the minima at about 10 eV and 70 eV.

These results will be discussed in greater detailed in comparison with the electron results at the conference.

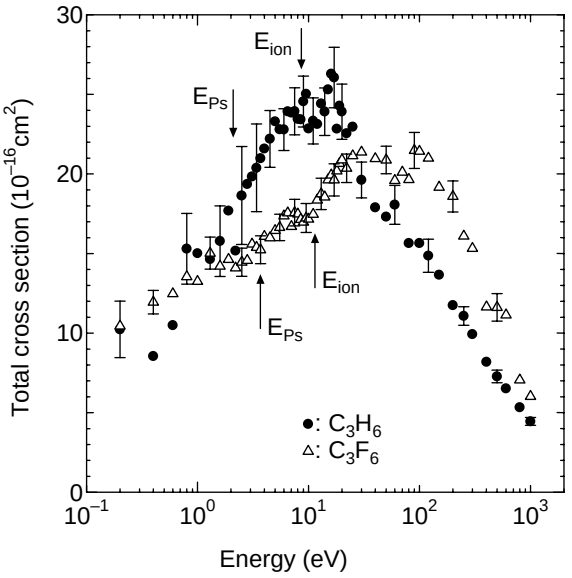

Fig. 1 C_3H_6 and C_3F_6 positron TCSs. Arrows show the thresholds for ionization, E_{ion}, and positronium formation, E_{Ps}, i.e. pointing downwards for C_3H_6 and upwards for C_3F_6.

References

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