ISOMER EFFECT BETWEEN PROPENE AND CYCLOPROPANE BY ELECTRON IMPACT

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We have carried out experimental and theoretical studies on electron scattering from the propene (C_3H_6) and cyclopropane (cyclo-C_3H_6). Total and differential cross sections (TCS and DCS) are reported for these molecules. Hydrocarbon molecules play an important role in several areas of applications, e.g. plasma diagnostics in the Tokamak fusion divertor [1]. To our knowledge, there are some few attempts that studied the isomer effect in these molecules by electron impact [2]. In this study, we examine the similarities and differences observed in the cross sections between these molecules due to the isomer effects and provide some rationale on the collision dynamics for electron impact.

A retarding-potential time-of-flight (RP-TOF) apparatus [3] was used for total cross section measurements, while the differential cross sections were measured using the crossed-beam setup, which was same as used in our previous studies [4].

Fig. 1 shows the TCSs for these molecules at energies 0.4 – 1000 eV. TCSs for C_3H_6 are larger than cyclo-C_3H_6 below 60 eV and show a lower energy peak at ~2.2 eV before the larger and broader one at ~9 eV, which is attributed to the shape resonance due to vibrational excitation of C_3H_6 molecules. Both TCSs become approximately equal above 60 eV.

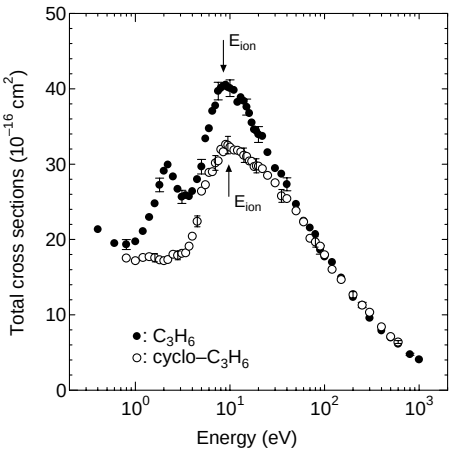

Fig. 1. TCSs for C_3H_6 and cyclo-C_3H_6 in energy range of 0.4 – 1000 eV. Arrows show the thresholds for ionization.

Fig. 2 shows the DCSs for elastic scattering from C_3H_6 and cyclo-C_3H_6 at 2 and 5 eV. These results show the most drastic difference between these two isomer molecules. As shown in Fig. 2, forward scattering for C_3H_6 is stronger than that for cyclo-C_3H_6. It was considered that this result was due to the presence of the dipole moment and larger polarizability in the C_3H_6 than the non-polar cyclo-C_3H_6.

At the conference, we will compare these experimental results with the cross sections calculated by the Continuum Multiple Scattering method [5] and discuss in detail the isomer effect in the cross sections for these molecules.

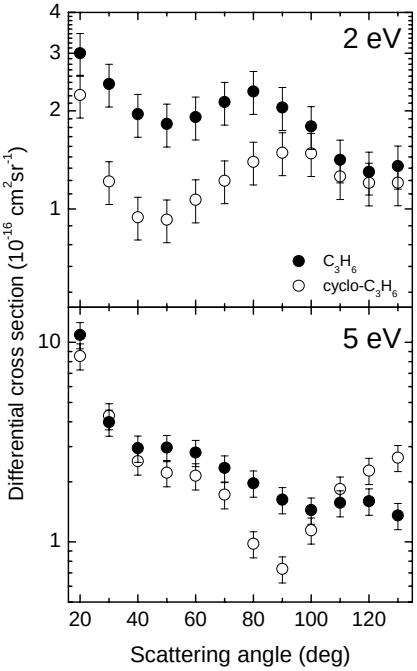

Fig. 2. DCSs for C_3H_6 and cyclo-C_3H_6 by electron impact at 2 and 5 eV.

References

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