Electronic excitation of C_4F_6 isomers by electron impact

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Electronic excitation of C_4F_6 isomers by electron impact

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Synopsis We have measured electronic excitation differential cross sections for C_4F_6 molecules isomers by electron impact. In the case of hexafluoro-1,3-butadiene we observed an optical forbidden transition at around 5 eV. The spectra of the three C_4F_6 isomers show the most intense band clearly shifted to lower energies when going from 2-C_4F_6, to c-C_4F_6 and to 1,3-C_4F_6.

We report on the measurement of electronic excitation differential cross sections (DCSs) for C_4F_6 molecules by electron impact. C_4F_6 has three isomers, hexafluoro-1,3-butadiene (1,3-C_4F_6), hexafluoro-2-butyne (2-C_4F_6) and hexafluorocyclobutene (c-C_4F_6). 1,3-C_4F_6 molecule has been suggested as a potential plasma processing molecule to be used as a replacement to the traditional reactive etching gases[1], having a negligible global warming potential. So far the only electron scattering experiments for 1,3-C_4F_6 have been reported by Szmytkowski and Kwitnewski[2] on the absolute total cross sections (TCSs), at an incident electron energy from 0.6 to 370 eV.

The apparatus for the DCSs measurements consist of a crossed-beam method in conjunction with the relative flow technique[3]. These measurements were carried out at incident electron energies of 100 and 30 eV and scattering angles of 3° and 30°. Figure 1 shows the electron energy loss spectra of 1,3-C_4F_6. The intensity ratios of these two spectra have been both normalized at the 7.5 eV peak. These spectra show two broad peaks as characteristic structure of fluorocarbon molecules, and we observe an optical forbidden transition appearing at an energy loss of 4 - 5 eV. We referred to the photoabsorption spectrum[4] for the assignment of these Rydberg series converging to the lowest ionisation potential at 9.5eV corresponding to a removal of a π electron. These assignments have been obtained through the standard Rydberg equation. The isomers have similar structure, but their energy loss of features are obviously shifted in respect to 1,3-C_4F_6. These other isomer molecules results will be presented in detail at the conference.

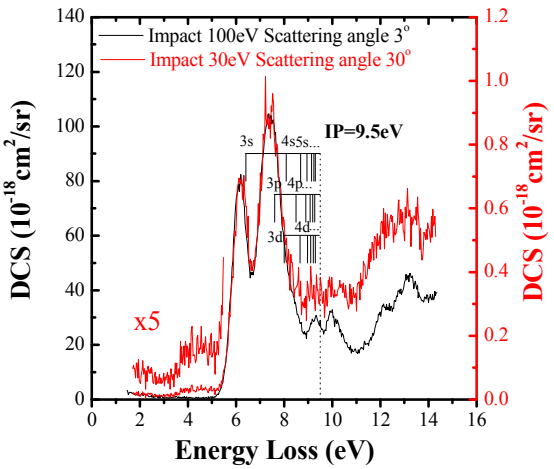

Figure 1. Electron energy loss spectra for electron scattering from 1,3-C_4F_6 .

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