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THE DISSOCIATIVE IONIZATION OF C_2H_2. THE H-C_2H BINDING ENERGY.

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The dissociative ionization of C_2H_2, C_2D_2 and C_2HD has been investigated by electroionization mass spectrometry and ion translational energy spectroscopy. The proton (deuteron) and (deuterated) ethynyl ion-producing channels have been studied in detail. The results provide the data needed for an evaluation of the H-C_2H binding energy.

The translational energy distribution of H^+ and D^+, recorded between 22-100 eV impinging electron energy, shows a purely thermal peak and structures at about 0.2 eV and 1.2 eV ion energy. Above 40 eV electron energy the distribution is spread up to 10 eV ion energy. The C_2H^+ (C_2D^+) ions carry less than 10 meV translational energy.

Several appearance energies are observed in the first differentiated ionization efficiency curves of H^+ (D^+). The lowest onset is measured at 18.9 ± 0.2 eV for zero kinetic energy protons. This onset energy is assigned to the process $C_2H_2+e^- \rightarrow C_2H$ ($X^2\Sigma^+$, v=0)$+H^+$ (^1S_g)$+2e^-$ This process involves a predissociation mechanism of the $C_2H_2^+$ ($B^2\Sigma_u^+$) by the $C_2H_2^+$ (A^2A_g) state. At higher energies, electronic excited states of the ethynyl radical are involved. The dissociation process $C_2H_2+e^- \rightarrow C_2H^+$ ($X^3\Pi$)$+H^+$ (^1S_g)$+3e^-$ is assigned to the onset at 34.2 ± 0.4 eV. This investigation provided a binding energy $D(H\text{-}C_2H)$= 5.33 ± 0.23 *e*V. This value will be discussed in detail at the meeting.

The lowest onset measured for C_2H^+ is at 17.30 ± 0.08 eV, in very good agreement with most of the previously reported results obtained by electron impact and photo-ionization experiments. This onset is ascribed to, $C_2H_2+e^- \rightarrow C_2H^+$ ($X^3\Pi$)$+H$ (^2S_g)$+2e^-$. The evaluation of D(H-C_2H) through this reaction path is less appropriate. The upper limit of 10 meV on the translational energy carried by C_2H^+ implies 0.26 eV uncertainty on the total energy balance of the above mentioned reaction.