

## Chemical Reactions in the Cluster Ions of 1,1-Difluoroethene and Argon

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We have investigated the clusters of 1,1-Difluoroethene (DFE) and Argon by means of photoionization with synchrotron radiation in the 0th order of the 1.5m NIM beam line at BESSY. A quadrupole spectrometer (QMS) has been used to mass select cluster ions.

The clusters were prepared either in a pure molecular beam (pmB) of DFE or in a molecular beam seeded in Argon. Typically 3 to 5 bar of pure DFE or its mixture with Argon were expanded through a cylindrical nozzle of 70 $\mu$ m diameter. The nozzle was operated at a temperature of 255K. Depending on the mixing ratio different fragmentation patterns were observed in the mass spectra indicating different compositions of the neutral cluster beam. Larger clusters (trimer and higher) seem to be favored by mixing ratios between 30:1 and 60:1 (Ar to DFE). At a mixing ratio of 50:1 (Ar to DFE) the DFE dimer is the most abundant ion in the mass spectrum apart from the Ar monomer.

The mass spectra are dominated by the peaks of the homogeneous DFE clusters which are always more intense than the fragments that can formally be described by reactions starting from these clusters. The fragmentation pattern is similar for the different regions of the spectrum (figure 1A, 1C, 1E and 1B, 1D, 1F). In addition to each homogeneous DFE cluster the protonated clusters and 4 different fragments were observed that can formally be described by the following reactions. However we have to emphasize that the initially formed precursor of each detected fragment is not known unambiguously.

The intensity of the homogeneous Ar Clusters seems to be suppressed by the presence of DFE in the beam. No  $\text{Ar}_3^+$  has been observed if the fraction of DFE is larger than 2%, while in an equivalent pmB expansion the  $\text{Ar}_3^+$  intensity is comparable to the  $\text{Ar}_2^+$  intensity.



In the future we plan to perform a more detailed investigation of DFE/Ar clusters by means of the TPEPICO technique. It would be interesting to determine the parent cluster ion (precursor) for all cluster fragments observed here. This includes the question whether the  $\text{DFE}_{n-1} \cdot \text{C}_2\text{H}_2\text{F}^+$  originates from a  $\text{DFE}_n^+$  cluster by F/HF loss or from the protonated cluster ( $\text{DFE}_n\text{H}^+$ ) by the loss of 2 HF molecules.

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**Figure 1:** Mass spectra of 1,1-Difluoroethene clusters recorded in Oth order of the monochromator with a quadrupole mass filter under different conditions. The scale of A, C and E is normalized to 20% of the  $\text{DFE}_2^+$  yield, that of B, D and F is normalized to 50% of the  $\text{DFE}_3^+$  yield. Experimental conditions: A-B) 3 bar DFE pmB,  $T_{\text{nozzle}} = 255\text{K}$  (the absolute scale of A is 8 times larger than in B); C-D) 5 bar of a 50:1 mixture of Ar and DFE,  $T_{\text{nozzle}} = 255\text{K}$  (the absolute scale of C is 2 times larger than in D); E-F) 5 bar of a 120:1 mixture Ar and DFE,  $T_{\text{nozzle}} = 255\text{K}$  (the absolute scale of E is 4 times larger than in F).

