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Reference: Short visit Grant EIPAM
Beneficiary: Helga Dögg Flosadóttir, Raunvísindastofnun Háskóla Íslands, Reykjavík, Iceland
Host: professor Eugen Illenberger, Freie Universität, Berlin
Period: 27.09.07-25.10.07, 28 days, Berlin, Germany
Reference code: EIPAM 2015

SCIENTIFIC REPORT

Purpose of visit

The purpose of the visit was to measure the dissociative electron attachment to nucleotides on the new and promising instrument, Laser Induced Acoustic Desorption (LIAD). This instrument has the ability to introduce large molecules intact into the gas phase. And to improve the instrument by changing the way the laser is introduced to the sample holder.

The use of Laser Induced Acoustic Desorption (LIAD) to desorbe neutral molecules from a surface is an attractive alternative to evaporation by resistive heating, as well as matrix assisted laser desorption (MALDI). LIAD has the potential to enable dissociative electron attachment measurements on larger molecules than is possible by methods now commonly used. This is now being tested on larger systems with very promising results. In this instrumentation the sample molecules are deposited as a thin layer on a titanium foil with 12.7 microns thickness. A pulsed Nd:YAG laser irradiates the foil from the backside and creates shock waves that lead to desorption of the molecules at the opposite side. The desorbed neutral and intact molecules interact with a low energy electron beam (0-20 eV) and the generated anions are mass selected and detected with a quadrupole mass spectrometer in dependency of the incident electron energy..

Work carried out

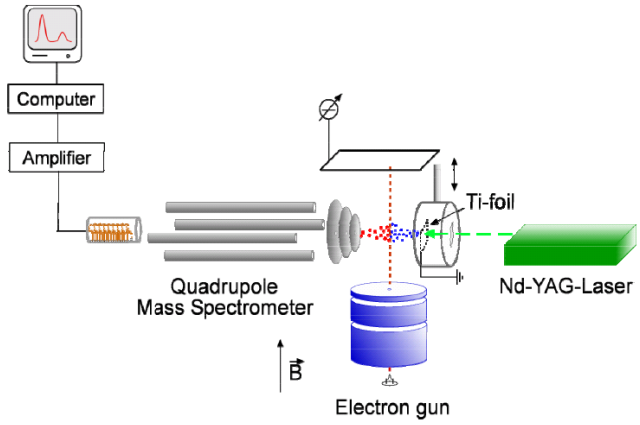


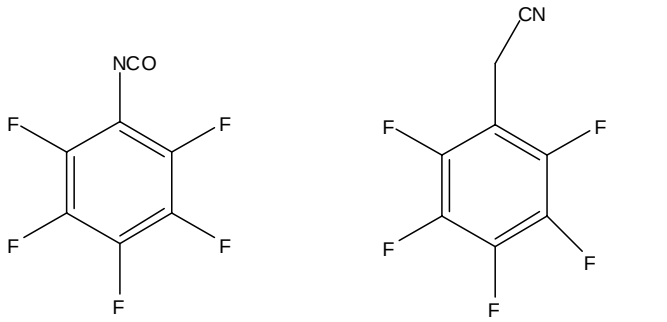
Figure 1
Laser Induced Acoustic Desoptoin (LIAD) instrument. The laser is introduced to the back side of the sample holder wich is a 13 μm thick titanium foil. The laser causes an acoustic shock wave wich shakes the molecules on the other side off – thus forming intact neutral gas phase molecules.

During the period of the short visit experiments were carried out on two different instruments. A gas phase electron attachment instrument with a trochoidal electron monochromator and a quadrupole mass spectrometer, as well as on the Laser Induced Acoustic Desorption (LIAD) electron attachment instrument. Figure 1 shows the setup of the LIAD.

Previous measurements done on the LIAD were gained by leading the laser beam through an optic fiber into the chamber. This fiber could not hold all the power available from the source so it had to be scaled down, causing less desorption than possible with higher power and thus lower peak

intensities. We now exchanged this fiber for lens optics in order to use fully the power available from the laser source and thus get higher signal peak intensity. First measurements on 5'-Guanosine monophosphate were done to check the progress achieved. Now the signal intensity rose from the 10 counts/second that it was before up to 2000 counts/second.

In the gas phase experiments we measured two different pentafluorinatet systems, pentafluorophenyl isocyanate and pentafluorophenyl acetonitrile, figure 2 shows the structure of these compounds. These compounds have a very stable parent anion formed at electron energies close to 0 eV, nothing else appears at that low energy. Other m/Z ratios observed for pentafluorophenyl isocyanate were 193 amu, 167 amu, 42 amu, 26 amu, and 19 amu. Those were assigned to $[M\text{-}O]^-$, $[M\text{-}NCO]^-$, CNO^- , CN^- and F^-. Two more fragments were observed at 112 amu and 164 amu which have not been assigned. For pentafluoro acetonitrile the m/Z ratios observed were 188 amu, 181 amu, 167 amu and 26 amu those were assigned to $[M\text{-}F]^-$, $[M\text{-}CN]^-$, $[C_6F_5]^-$ and $[CN]^-$ respectively.



Pentafluorophenyl isocyanate pentafluorophenylacetonitrile

Figure 1
The molecular structure of the molecules measured in the gas phase experiments. Comparison of these two will lead to great knowledge on the different behaviour of fluorinated aromatic structures.

Collaborations and Publications

Further collaboration between the groups of Prof. Ingolfsson and Prof. Illenberger have already been organized with regards to instrumental work on the LIAD. Helga Dögg will do further work on the LIAD within the frame of this colaboratin. This work will be suprviced to a large extedt by Ilko Bald. Ilko bald will also spend an extended period in Iceland working of electron attachment instrumentation that is being built at the ubiversity of Iceland. The collaboration between Prof. Ingolfsson at the University of Iceland and Prof. Illenberger at the Freie Universitaet Berlin is initiated through excange whisits both supported by the COST Action P09; RADAM and from the EIPAM program. The collaboration has been very fruitful and already resulted in two joint publications and three more are in preparation.

The progress on the LIAD during this whisit was mainly instrumental and. The experimental results are preliminary and will not be published without further measurements. The gasphase experiments on the other hand are in preparation por publication. A poster will be presented at the next EIPAM meeting on the work done and a Talk will be given by Helga Dögg Flosadóttir in a Chemistry seminar at the University of Iceland.