SCIENTIFIC REPORT

Title: Low energy electron induced reactions in organic acids

REFERENCE: Short Term Scientific Mission, COST CM0601

Beneficiary: Dr. Janina Kopyra, University of Podlasie

Host: Prof. Dr. Eugen Illenberger, Freie Universität Berlin

Period: from 01/03/2009 to 31/03/2009 Place: D-14195 Berlin (DE)

Reference code: COST-STSM-CM0601-04449

Purpose of the visit

The purpose of the visit was to investigate interaction of the low energy electrons with gas phase molecules by means of crossed electron/molecular beams technique.

Description of the work carried out

The experiments were performed in a crossed electron/molecular beam setup which consists of an electron source, an oven, a quadrupole mass analyzer and a detection system. The electron beam of the defined energy is generated by a trochoidal electron monochromator and crosses perpendicularly with the molecular beam under investigation. The generated negative ions are extracted by a weak electric field and accelerated by a series of parallel electrodes onto the entrance hole of the quadrupole mass analyzer and detected by a single pulse counting technique as a function of incident electron energy. Calibration of the electron energy scale and estimation of the electron energy was established using the well-known electron attachment process SF_6^-/SF_6.

Description of the main results obtained

During my stay in the Berlin laboratory I was involved in the study of the 4-oxopentanoic acid, N-acetylglycine and cis-platin compounds by electron attachment.

<u>4-oxopentanoic acid</u>

The only anionic fragment that was observed from 4-oxopentanoic acid is the closed shell anion $(M\text{-}H)^-$ which arise from the loss of a neutral hydrogen atom. The fragment is visible within the peak at 1.5 eV.

N-acetylglycine

Low energy electron interaction with N-acetylglycine leads to the formation of the following fragment negative ions:

$CH_3C(O)NHCH_2COOH + e^- \rightarrow CH_3C(O)NHCH_2COO^- + H$	116 amu
$\rightarrow (M\text{-}H_2CO_2)^- +$ neutral fragments	71 amu
$\rightarrow CH_3C(O)NH^- / H_2C_2O_2^- +$ neutral fragments	58 amu
$\rightarrow CN^- / C_2H_2^- +$ neutral fragments	26 amu
$\rightarrow OH^- +$ neutral fragments	17 amu

The most intensive signal was observed at 116 amu and assigned as $(M\text{-}H)^-$. The formation of this ion results via a simple bond cleavage and is observed via low energy resonance at 0.8 eV with a shoulder at around 1.8 eV. The other two quite intensive resonances at 71 amu and 58 amu appear at 0.8 eV and 1.4 eV, respectively. While the former fragment is assigned as $(M\text{-}H_2CO_2)^-$ the assignment of the latter one is ambiguous since there are two possible structures of the anionic product such as $CH_3C(O)NH^-$ and $H_2C_2O_2^-$. As for the fragment at 58 amu two structures are possible for the fragment detected at 26 amu, i.e., CN^- and $C_2H_2^-$. Besides, the fragment at 17 amu (OH^-) was observed within two resonances first at low energy, slightly above zero eV, and the second one at around 6 eV.

Cis-platin

The experiment performed on cis-platin has shown that interaction of LEEs with this molecule leads to dissociation into various fragments. The anionic dissociation products are caused by following reaction pathways:

$$PtCl_2(NH_3)_2 + e^- \rightarrow Cl^- + PtCl(NH_3)_2$$
$$\rightarrow PtCl(NH_3)_2^- + Cl$$
$$\rightarrow Pt(NH_3)_2^- + Cl_2$$
$$\rightarrow NH_2^- + \text{neutral fragments}$$
$$\rightarrow 17 \text{ amu}$$

All of these anionic fragments are observed at low energy scale in the range of 0-1 eV and the only fragment NH_2^- is created at high energy of 5.5-6 eV and hence attributed to a core excited resonance.

Projected publications resulting from the grant

It is planned to publish the results as soon as the data analysis will be finished.