Freie Universität Berlin

Fachbereich Biologie, Chemie, Pharmazie
Institut für Chemie und Biochemie

Freie Universität Berlin, Institut für Chemie und Biochemie
Takustrasse 3, D-14195 Berlin

Prof. Dr. E. Illenberger
Physikalische und Theoretische Chemie
Takustrasse 3, D-14195 Berlin

Telefon: +49 30 838 55350 (52096)
Fax: +49 30 838 56612 (52717)
E-Mail: iln@chemie.fu-berlin.de
Internet: www.fu-berlin.de

Berlin, 01 March 2006

Host Report

Reference code: COST-STSM-P9-01803

During his visit to our laboratory Richard Balog studied electron stimulated desorption (ESD) of fragment anions and thermal desorption spectroscopy (TDS) in condensed phase CF_3COOH following low energy electron impact (0-20 eV). In ESD, the fragment ions H^- and F^- are observed via resonant features in the energy range 5 – 12 eV similar to the dissociative electron attachment (DEA) resonances present in gas phase CF_3COOH. Extended electron irradiation of the film leads to the formation of CO_2 and CHF_3/CF_4 as revealed by a combination of TDS and ESD experiments. The experiments concerning reactions induced by sub-excitation electrons (≈ 1eV) were so far not conclusive. Richard Balog will be the co-author of a publication entitled

Reactions in nanofilms of trifluoroacetic acid (CF_3COOH)
driven by low energy electrons

to be submitted to Phys. Chem. Chem. Phys. this month.

Eugen Illenberger
Professor of Physical Chemistry

Richard Balog
Department of Physics and Astronomy
University of Aarhus
Ny Munkegade, Bld. 520
DK-8000 Aarhus C

Telefon: +45 8942 3774
Fax: +45 8612 0740
E-Mail: balog@phys.au.dk

Scientific Report

Reference code: COST-STSM-P9-01803

The aim of my visit at the host institute in Berlin was to study the reactivity of CF_3COOD under the electron attack in the energy range 0-20eV. The products of reactions were investigated by means of electron stimulated desorption (ESD) and temperature programmed desorption (TPD).

We have observed that CF_3COOD efficiently transforms into CF_3COOH via D/H exchange inside the gas inlet system. The ratio of deuterated and hydrogenated samples deposited onto platinum substrate was monitored using TPD measurements, where amount of fragment ions $COOD^+$ (mass 46) and $COOH^+$ (mass 45) have been recorded. During the course of measurements after several fill and pump cycles we have obtained mass ratio 46/45 to be 2/1.

In ESD measurements two fragment ions have been observed, namely H^- (measured previously from CF_3COOH sample) and F^-. Both yields show a resonant structure in the energy range 5-14eV, which does not reveal any dramatic change in their shape and/or intensity with number of repetitive scans (irradiation). Obtained results were directly compared with results from the gas phase and cluster measurements performed in the same laboratory.

We have applied the TPD technique to analyze products generated by bombardment of CF_3COOD samples with electrons of fixed energy. One observation is that irradiation leads to the formation of CO_2 and most probably CF_3D. Extended irradiations at different incident energies show that CO_2 is efficiently formed above some threshold energy and continuously increases with increasing electron energy.

In the cluster measurements, electron attachment to CF_3COOH leads to the formation of $H_2O{\cdot}CF_3COO^-$ complex at 0.4eV. The question is whether such reaction takes place also in condensed phase. One can then check if negative species like $H_2O{\cdot}CF_3COO^-$ desorb from the surface after the heating. So far we did not observe negative ions using TPD technique. It is expected that anions formed at the top of the

molecular film diffuse to the substrate during the heating and then charge transfer to the metal substrate takes place prior to desorption. Another possibility is to check if H_2O or equivalently D_2O desorbs from the surface by monitoring masses 18 and 20. We have observed that, both masses do desorb even from nonirradiated CF_3COOD (CF_3COOH) film. Such signal may originate from water impurity in the sample and/or from the dimers. However, mass analysis of the evaporated film does not indicate any presence of the dimers.

Because of the unexpected shut down of the apparatus (change of the gold substrate by platinum substrate and consecutive backing of the chamber) at the beginning of my visit, there was no time left to finish the measurements proposed and search for water production from the irradiated CF_3COOD sample was still in progress.

Date: 03.03.2006 Signature: .....

COST Office
149 avenue Louise • 1050 Brussels • Belgium
Tel: +32 (0)2 533 38 00 • Fax: +32 (0)2 533 38 90
E-mail enquiries: office@cost.esf.org • Website: http://cost.cordis.lu

SHORT-TERM SCIENTIFIC MISSION

FINAL PAYMENT REQUEST FORM

COST Action Number: P9
Beneficiary's Name and Institution: Mr Richard Balog, University of Aarhus
Host's Name and Institution: Eugen Illenberger, Institut für Chemie- Physikalische und Theoretische Chemie
Period: from 23/01/2006 to 17/02/2006
Place: Berlin (DE)
Reference code: COST-STSM-P9-01803
Claimed amount of the grant: 2000.00 €

The above STSM has been successfully completed and the following documents are attached:

- **My Scientific report supported (email) by the host institution**
- **Approval by the Management Committee (email)**
- **My bank details as follows:**

Name of account holder: Richard Balog

Name of Bank: Danske Bank

Address of Bank:Universitets Afdeling,Stjernepladsen
8200 Aarhus N
Denmark,Aarhus (DK)

IBAN Account number: DK6930003635078014

Bank SWIFT code or BIC: DABADKKK

IBAN and BIC code are mandatory for EU-25 countries and EFTA-countries.
Without IBAN and BIC/SWIFT code, the Cost office will not be able to process your payment.
IBAN: International Bank Account Number
BIC: Bank Identifier Code (also called Swift address)

Date: 03.03.2006 Signature: Balog

For COST Office use:

Date Signature

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