Scientific Report: Low energy electron collisions with molecules

Institut de Chimie, Liège

The short term scientific mission approved by the COST programme on Radiation Damage in Biomolecular Systems was held at Institut de Chimie, Liège under the supervision of Dr. Marie-Jeanne HUBIN-FRANSKIN from 10/09/2004 till 20/09/2004.

The programme consisted of two parts. In the first part I was informed of activities in the laboratory concerning low energy electron collisions including elastic and inelastic scattering of electrons by gaseous tetrahydrofuran (C_4H_8O), which is the DNA backbone sugar-like analogue molecule. Relative differential cross section was measured for this molecule for the first time. In order to get absolute differential cross sections it is necessary to know the target density in the collision region. This problem can be solved by applying the method developed by Srivastava *et al* (1975), in which the relative target densities of an unknown and a secondary standard gas are accurately determined by a calibrated flowmeter and a pressure gauge. This method was already applied in this laboratory with methylamine (CH_3NH_2 and N_2 as a calibration standard (Motte – Tollet *et al* 1992). For the present measurement we will use the following procedure. Briefly, the intensity of electrons elastically scattered from N_2 will be measured and immediately followed by the measurements of the scattered electron intensity from tetrahydrofuran (C_4H_8O), under the same experimental conditions. The mass flow rate and the head pressures will be adjusted to reproduce as closely as possible the same flux distributions from the hypodermic needle of both N_2 in the form of gas and C_4H_8O in liquid form. Compared to existing methods, this is a novel approach. One of the main difficulties was the instability of the C_4H_8O line. The problem was solved by extra heating of the line. The work is in progress and will take much longer than my visit.

In the second part of the visit, I presented in form of a seminar on the 20/09/04, the results of my work in low energy electron collision with molecules.

The aim of the seminar was to show the influence of the resonant contributions in threshold spectra of CO, N_2, O_2 and H_2O (J.J.Jureta and S.Cvejanovic 2004). It was shown that the threshold spectroscopy can be a very powerful tool in study of optically forbidden states and resonances in molecular systems. This technique includes high energy resolution electron spectrometer and a very sensitive penetrating field method. The scattered electrons have a

very low energy, less than 20 meV, giving information of the processes very close to thresholds of the excited states. This technique can be used to study more complicated molecules including some biomolecules.

REFERENCES

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Acknowledgments

I am grateful to the support of European Cooperation in the field of Scientific and Technical Research, Action P9 – Radiation Damage in Biomolecular Systems. I am also grateful to Dr.Alexandre Giuliani and Dr Marie-Jeanne Hubin-Franskin for the hospitality during the visit.

Liège, 20/09/2004

Dr. JOZO JURETA

Jozo Jureta

Confirmation by the Host Institute of the Successful Execution of the Mission

Execution of the mission has been quite successful.
The host institution has benefited of the large expertise of Dr Jozo Jureta in low energy electron beams.
Future joint collaboration has been discussed

Liège 20/09/04

Dr Marie-Jeanne Hubin-Franskin
Directeur de recherche FNRS