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Electron scattering from tetrahydrofuran

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Synopsis Electron scattering from Tetrahydrofuran (C_4H_8O) was investigated over a wide range of energies. Following a mixed experimental and theoretical approach, total scattering, elastic scattering and ionization cross sections as well as electron energy loss distributions were obtained.

Due to its structure which is similar to that of pentoses present in DNA and RNA nucleotides, tetrahydrofuran (THF) serves as an intermediate step in the investigation of electron interaction properties of more complex biomolecules. Particularly when studying radiation damage through scattering experiments, DNA/RNA strands or even nucleotides are molecular targets difficult to handle under experimental conditions.

Here, we present experimental and theoretical results on electron scattering from gaseous THF. First, total cross sections were determined by measuring the beam attenuation in the medium-to-high-energy range (50-5000 eV) [1]. Electron-impact ionization experiments were carried out combining simultaneous electron and ion measurements with a time of flight analysis of the ionic fragments produced. Ionization cross sections obtained agree very well with calculations by Mozejko and Sanche [2].

Electron Energy Loss (EEL) spectra were measured in the keV range using a transmission beam technique that measures a mixture of small angles [3]. In fig. 1, it can be seen that while energy resolution is not sufficient for distinguishing vibrational or electronic excitations, this method is adequate for revealing the global energy loss landscape up to high energy losses.

Using an optical potential method assuming SCAR, a screening corrected independent atom representation [4], total, elastic and inelastic cross sections (1eV - 10keV) were also calculated in order to complement the experimental data. The agreement within 10% with our experimental results confirms that this model potential calculation is a good approximation for integral electron scattering cross sections in the common energy range.

Finally, present theoretical and experimental results will be used as the input data for LEPTS (Low-Energy Particle Track Simulation), a Monte Carlo programme code simulating electron and positron transport.

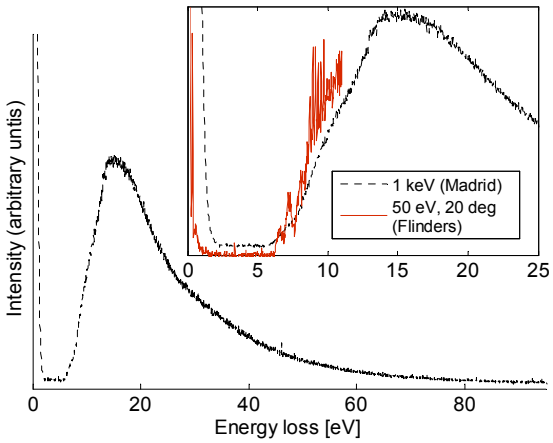

Figure 1. Comparison of high-energy (Madrid) spectrum to a low-energy distribution obtained by Do et al. [5] at Flinders University with a crossed-beam apparatus.

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