

# Absolute vibrational and electronic cross sections for low-energy electron scattering from condensed Thymidine

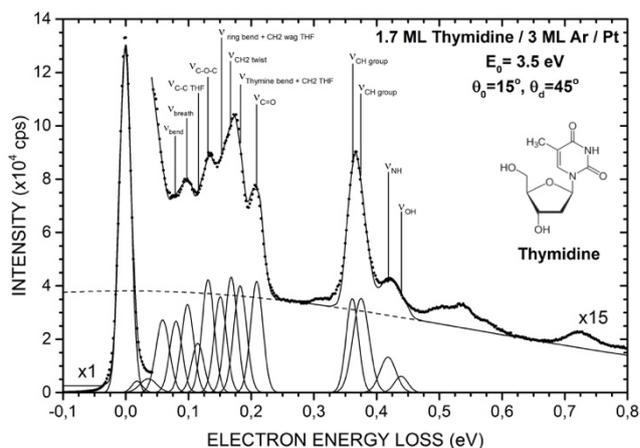
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**Synopsis** Absolute vibrational and electronic excitation cross sections (CSs) for low-energy electrons (1-18 eV) scattering from condensed thymidine (dT) are measured with High-Resolution Electron Energy Loss Spectroscopy (HREELS). EEL spectra are recorded and the vibrational and electronic modes of dT identified. Absolute CSs for these modes are extracted from each spectrum by a fitting procedure. Resonances are observed in the incident energy dependence of the CSs, below 3 eV and near 4, 8 and 10 eV. The CSs are compared to those of its constituents: thymine and tetrahydrofuran.

The primary goal of radiotherapy is to deliver lethal doses of radiation exclusively to cancer cells, while preserving healthy tissue. One novel approach is Targeted Radionuclide Therapy (TRT), in which Auger-electron-emitting radioisotopes are molecularly targeted towards cancer cells [1]. Biologically, significant damage is produced by the complex sequence of reactions initiated by the secondary species, which include the numerous low-energy electrons (LEEs). *Nanodosimetric* calculations are required to describe new modalities such as TRT. Modelling such treatments requires multiple parameters to describe the transport and reactions of secondary species in biological matter. Consequently, absolute cross sections (CSs) for the interactions of LEEs with DNA and/or its component sub-units in the condensed phase are required for cellular nanodosimetry [1]. Here we present absolute CSs for vibrational excitations of condensed Thymidine (dT), which is a nucleoside, composed of Thymine (DNA base) and deoxyribose. Electron energy loss spectra (Fig. 1) for 1.7 monolayers (ML) of dT deposited on 3 ML of an Ar spacer on a Pt substrate at 19 K, were recorded in vacuum, for electron incident energies between 1 and 18 eV using a high resolution electron energy loss spectrometer. As in our earlier studies [2, 3], the CSs were determined at fixed energies, by fitting each energy loss spectrum with multiple Gaussian functions. These latter were centered at the expected energy loss of each mode. The energy dependence of the CSs for each excitation mode exhibits multiple features that can be related to tran-

sient anion states located at energies below 3 eV, and near 4, 8 and 10 eV. These absolute CSs values for dT are quantitatively compared to those previously measured for thymine [4] and tetrahydrofuran (a model for deoxyribose) [2]. Hence, we can find out, if the CSs for a complex molecule, such as dT, can be represented by the sum of CSs of its constituent subunits.



**Figure 1.** Representative EEL spectrum for incident electron of 3.5 eV scattering from 1.7 monolayer of thymidine.

## References

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- [4] Lévesque P L *et al* 2003 *Nucl. Inst. and Meth. in Phys. Res. B* **208** 225

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