Double differential ionization cross section of tetrahydrofuran for proton impact

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Synopsis Double differential (in angle and energy) ionization cross sections were experimentally determined for the collisions of protons with a tetrahydrofuran gas target at impact energies between 100 keV and 1910 keV in the angular range between 15° and 165° relative to the beam direction. The derived absolute double differential cross sections will be included in the BioQuaRT [1] multi-scale track structure simulation program.

Within the framework of the EMRP Project "BioQuaRT" [1] the double differential cross sections (DDCS) for ionization of tetrahydrofuran (THF) by proton impact were measured in the projectile energy range between 100 keV and 1910 keV.

The experiments were carried out at the lately developed 150 kV electrostatic and the 3.75 MV Van de Graaff accelerators at PTB (Braunschweig, Germany). The emitted electrons were measured with a recently upgraded ESA-22-type electrostatic electron spectrometer developed at Atomki (Debrecen, Hungary). A detailed description of this type of analyzer is presented in Ref. [2]. The electrons were detected simultaneously at polar angles between ±15° and ±165° (except ±90°) in 15° steps relative to the beam direction.

The absolute normalization was performed by collecting electron spectra from collisions of 100 keV, 300 keV and 2 MeV protons with argon and comparing them with the experimental data of Rudd *et al* [3]. Because of the cylindrical symmetry of the collision system (the tetrahydrofuran molecules were randomly oriented), the experimental double differential cross sections were averaged for the symmetric emission angles relative to the projectile momentum vector.

Figure 1 shows preliminary results of the measured double differential cross sections for the ionization of tetrahydrofuran by 100 keV protons. The absolute values were derived by the comparison of our measurement and the experimental data from Ref. [3] for the collision of 100 keV protons with argon. The reference values for emission angles and secondary electron energies missing in Ref. [3] were determined by linear interpolation. The error bars denote the standard errors of the mean.

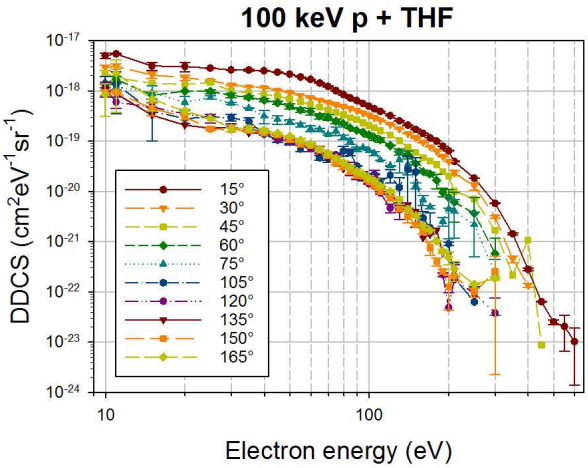

Figure 1. Absolute double differential ionization cross sections (DDCS) for the ejection of secondary electrons by collision of 100 keV protons with tetrahydrofuran (THF) at different emission angles (see legend) relative to the proton beam direction as a function of the electron energy. The error bars indicate the standard errors of the mean.

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References

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