

Total Cross Section for Electrons Colliding with Molecules

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The interest in the studies of low-energy electrons colliding with molecules has been increasing significantly in the last decade. There are, for instance, several studies indicating that electrons with energy well below ionization threshold is of fundamental importance to cellular damage [1]. With the objective of place Brazil in the select group of countries that are able to investigate experimentally these processes, involving low energies electron beams, in the Laboratório de Física Atômica e Molecular - UFJF is being developed a new apparatus for measuring Total Cross Section (TCS) for electrons scattering by atoms or molecules, covering the energy region from 10 to 500 eV.

We report in this work the firsts TCS measurements produced in this new apparatus, which reveal the excellent efficiency achieved for the energies above 50 eV, up to now. That apparatus makes use of two vacuum chambers, covered by 5 layers of a mu-metal shield, which are differentially pumped by two turbo molecular pumps. The first chamber houses the electron gun and the second the scattering-cell and analyzer region, avoiding changes in the electron emission characteristics, when gas is introduced in the scattering-cell.

The absolute TCSs for electron scattering by molecules, at a fixed impact energy, are obtained using the well-known linear transmission technique, by measuring the intensity of a transmitted electron beam, when there is no gas and some gas in a scattering-cell and then applying the Beer-Lambert law. The apparatus which may produce electrons beams with energies from 2 to 500 eV with appreciable intensity, has demonstrated an excellent performance over the energy range from 50 to 500eV, up to now. The apparatus is being commissioned to extend its lower impact energy region to 2 eV. Additionally, we are currently collecting SCT data for butanol and propanol in the energy range (50-500 eV), which will be unprecedented in the literature.

We have produced SCT for electron scattering for Argon, Helium and Nitrogen in the energy region

from 50 to 500 eV, obtaining an excellent agreement with data from literature, as it is show in Figure 1, for N₂.

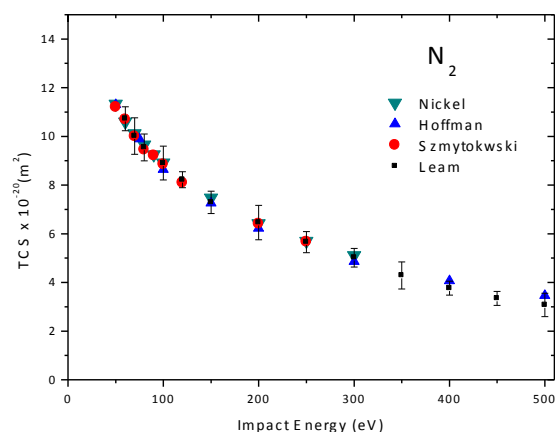


Figure 1. TCS for electron collision with nitrogen molecule, for impact energies from 50 to 500eV. Szmytkowzky [2]; Nickel [3]; N₂: Nickel [4]; Hoffman [5]; Szmytkowzky [6]. Note the excellent agreement on data from LEAM/UFJF with published data revealing the excellent efficiency achieved by the apparatus developed in our laboratory at UFJF.

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