

dance with the predictions given by Smirnov, it was found that two-electron loss cross section values (σ_{11}) are very close to those for one-electron loss process of neutrals (σ_{01}). Three-electron loss cross sections decrease with increasing the second ionization potential of the primary particle and gas target mass number, Z , similarly as for two-electron loss process.

In the investigated energy range, two- and three-electron loss cross sections increase sharply and monotonically with energy, while those for one-electron loss process, are, in general, independent on energy, or in some cases increase very slowly with energy.

1.3 Electron detachment in $H^- - H$ and $O^- - O$ collisions

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Abstract

A semiclassical two-state approximation of the collisional electron detachment is given in impact parameter treatment. Averaging the auto-ionization width in the continuum, for the reaction probability the following expression is obtained

$$\omega(\varrho, v) = 1 - \exp \left[\frac{-2\Gamma}{v} (R_0^2 - \varrho^2)^{1/2} \right], \quad (1)$$

where R_0 is the stabilization internuclear distance, Γ is the averaged width in the interval $(0, R_0)$ ϱ is the impact parameter and v is the relative velocity of the colliding particles. The reaction cross section is obtained in the form:

$$Q(v) = \pi R_0^2 \left\{ 1 - \frac{2}{a^2} [1 - (1+a)e^{-a}] \right\}, \quad (2)$$

where $a = \frac{2\Gamma R_0}{v}$.

The formulae (1) and (2) refer both to symmetrical and antisymmetrical potential modes.

The total collisional detachment cross sections for $H^- - H$ and $O^- - O$ reactions are calculated and good agreement is obtained with the experimental data.

1.4 Electron-impact K-ionization cross-section for C and Al in the keV region

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While in recent years the study of cross-sections of atoms in outer shells by electron impact has been subject of growing interest in experimental and theoretical work, experimental data on inner shell ionization cross-sections are still rare as well as accurate evaluation of these data. Lotz¹⁾ developed an empirical formula which covers also inner shell ionization. But experimental results of inner shell ionization cross-sections of low Z atoms - these are needed rather than data for high Z atoms in the fields of astrophysics, plasma physics and quantitative micro-

analysis with electron probes - are given only by Glupe and Mehlhorn²⁾, and Hink and Ziegler³⁾.

There are two methods for measuring the cross-section, e. g. for K-shell ionization. The first makes use of the emission of an Auger-electron following the process of ionization alternatively to the emission of a K-quantum. Glupe and Mehlhorn²⁾ used this method to determine the absolute K-ionization cross-sections of gaseous C, N, O, and Ne-targets. The authors used the second (conventional) method which is based on the indication of a hole in the K-shell by the alternatively emitted K-quantum to determine the absolute ionization cross-sections of solid thin film C and Al targets for electron impact energies in the region of a few keV to about 30 keV.

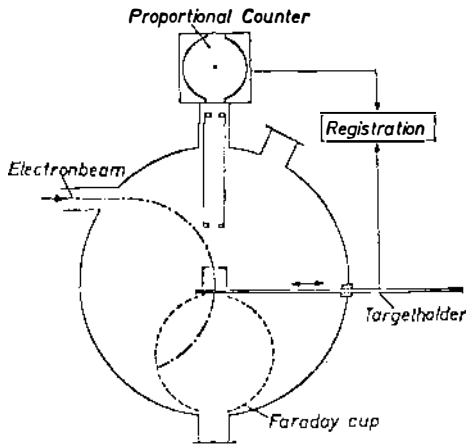


Fig. 1

The experimental arrangement is shown in Fig. 1³⁾. A beam of monoenergetic electrons is focussed with diameter less than 1.5 mm on the unsupported or Pioloform-backed thin film target ($1.2 \mu\text{g}/\text{cm}^2 < \rho d < 30 \mu\text{g}/\text{cm}^2$). The beam enters the target normally thereby minimizing the back scattering of electrons and the emission of bremsstrahlung in backward direction which is used for observation.

The ionization cross-section Q_K of the K-shell was evaluated from the number N_{reg} of registered K-quanta according to formula:

$$Q_K = \frac{1}{\omega_K} \cdot \frac{4\pi}{\Omega} \cdot \frac{A}{N_A \cdot \rho \cdot d} \cdot \frac{1}{q/e} \cdot \frac{N_{\text{reg}}}{\varepsilon}$$

- $\rho \cdot N_A / A$ number of target atoms per unit volume,
 ω_K fluorescence yield of the K-shell,
 Ω solid angle of observation,
 q/e number of electrons impinging on the target,
 ε counting efficiency of the proportional counter,
 ρd mass-thickness of the target.

The measurements had to be corrected in some cases for 1. scattering of electrons within the target, and 2. backscattering of electrons from the Pioloform-backening.

Inspection of recent literature together with the evaluation of the experimental results of the authors in the low Z region shows that the semi-empirical formula for ω_K given by Byrne and Howarth⁴⁾ for medium Z elements, may be extended to low Z elements. Using these values for ω_K all available experimental results in the low Z region are in reasonable agreement with the semi-empirical Gryzinski-formula⁵⁾ for Q_K inclusive the Glupe-Mehlhorn data. The latter are evaluated with