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Low energy differential elastic electron scattering from trichloromethane

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Synopsis Experimental differential cross sections for low energy electron scattering from trichloromethane is measured utilizing a crossed electron-molecular beam experiment via the relative flow method, for the incident electron energies in the range of $E_0 = 0.5\text{ eV}-30\text{ eV}$ and the scattering angles in the range of $\theta = 10^\circ - 130^\circ$.

Low-energy electron collision processes play an important role in several areas including astrophysics, radiation biology, atmospheric chemistry and technology. When considering the inelastic and elastic collisions, the former constitutes a dominant process of low-energy electron transport through gaseous media, plasmas and condensed matter. In our present work we provide the elastic differential cross sections (DCSs) for low energy electron scattering from trichloromethane - the organic compound with formula CHCl_3 .

The experimental setup employs a crossed electron/target beam arrangement. The energy separation of electrons is made at high resolution (40-50 meV FWHM) using electrostatic lenses combined with hemispherical analyzers [1]. In order to accurately determine background scattered electrons we employ a movable collimated gas beam source [2] developed in our laboratory.

The DCSs for trichloromethane, $Q_A(E_0, \theta)$ are obtained from the relative-flow formula:

$$Q_A(E_0, \theta) = Q_{\text{He}}(E_0, \theta) \frac{\mathcal{R}_{\text{He}} I_{S,A}}{\mathcal{R}_A I_{S,\text{He}}} \sqrt{\frac{M_{\text{He}}}{M_A}}, \quad (1)$$

where \mathcal{R} stands for the relative flow rates, I_S represents the scattering rates and M represents the molar masses where the subscripts indicate the gas species, with A being the unknown gas (trichloromethane) whose DCS is to be determined and He the standard gas (helium) whose DCSs are known; thus our measured trichloromethane DCSs were normalized to elastic DCSs for helium.

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We will present the experimental data on differential cross sections for elastic electron scattering on CHCl_3 for range of energies (0.5, 1, 2, 3, 4, 5, 7, 10, 15, 20, 30 eV) and the scattering angles ($10^\circ - 130^\circ$). An example of the data for four incident electron energies is shown in Fig. 1.

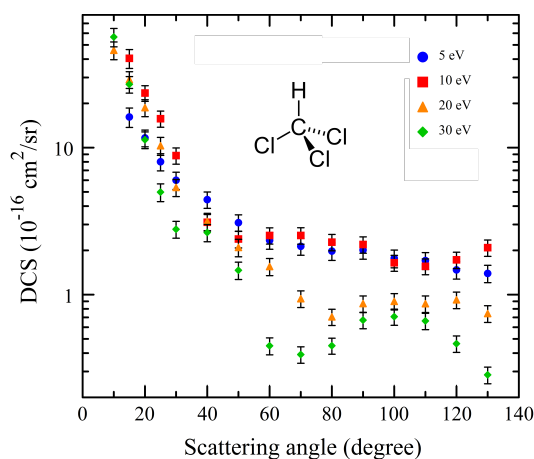


Figure 1. Differential cross sections for elastic electron scattering by trichloromethane.

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