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Absolute differential and integral cross sections for CCl_4 molecules by low energy electron impact

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Synopsis We report absolute differential cross sections (DCSs) and integral cross sections (ICSs) for elastic electron scattering with CCl_4 molecules in the energy range of 1.5-100eV. In addition, the experimental DCSs are compared with the results from theoretical calculations based on the Schwinger multichannel method with norm-conserving pseudopotentials.

Understanding of the reactive mechanisms in the ozone layer requires quantitative cross-sectional data from collisions of ozone-depleting compounds such as radical productions from CCl_4 molecules with low energy electrons. We have reported DCSs for CF_xCl_{4-x} (x = 1 – 4) molecules where they rises at forward scattering angles due to dipole moment increasing in the elastic scattering process at low energy electron impact [1]. In the present contribution, we have measured elastic DCS for CCl_4 molecules in the energy range 1.5–100 eV at scattering angles 15°–130°.

The experimental apparatus used is a typical crossed-beam setup used in conjunction with the relative flow technique [2]. All measurements were carried out using He as a reference gas which enables the use of rational functions for the conversion from relative intensities to absolute values. The experimental resolution was about 40 meV and errors in the cross sections were estimated to be 15–20%. We compared the experimental DCSs with theoretical calculations based on the Schwinger multichannel method (SMC) [3] with norm-conserving pseudopotentials. The calculated DCSs are in good agreement with the experimental results at low energies. Furthermore, from the measured DCSs, elastic ICSs have been evaluated by extrapolating DCS based on both the SMC calculations and partial wave fitting.

Figure 1 shows the results for ICSs for elastic electron scattering with CCl_4 molecules. ICSs show an excellent agreement with other experimental data [4] in the energy range of 3–20 eV. In addition, ICSs summed for elastic and vibrational contributions in the energy range 1.5–2.0 eV and summed for elastic and ionisation contribution in the energy range of 30–100 eV, show also an excellent agreement with other experimental data [4]. Detailed discussion of these and other results will be presented at the conference.

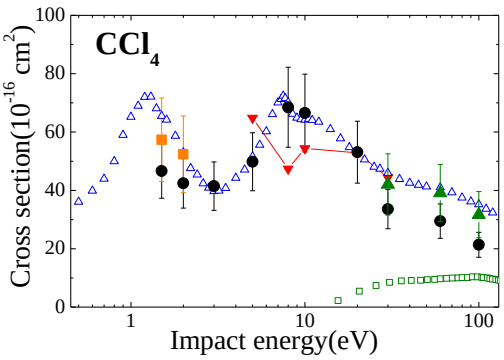

Figure 1. ICSs for elastic electron scattering with CCl4 molecules. ●: Elastic, ■: Sum of Elastic and Vibrational, ▲: Sum of Elastic and Ionisation [5] □: Ionisation [5], ▼: Elastic SMC calculation, △: Total cross section [4].

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