§13. Total Electron Scattering from Carbon Dioxide

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Carbon dioxide has received much interest in the field of molecular collision physics, planetary atomospheric science, aeronomy, and laser physics. In the molecular collision physics, many theoretical and experimental efforts have been done. Nevertheless, agreement among data is not sufficient. The total electron scattering cross sections σ_t were reported by many authors. We can see several results as a typical example. Hoffman *et al.*(2-50 eV)[1], Szmytkowski *et al.*(0.5-2916 eV)[2], and Kimura *et al.*(1-500 eV)[3] measured σ_t in high energy resolution. Garcia and Manero gave experimental results at high electron energies(400-5000 eV)[4]. Jain and Balija (10-5000 eV)[5] calculated σ_t with an optical model potential. Results of Hoffman *et al.* are higher than those of Szmytkowski *et al.* in the energy range between 10 and 50 eV. Results of Garcia and Manero show a little lower values at around 400 eV and higher at energies above 1500 eV than those of Szmytkowski *et al.* Theoretical results of Jain and Baluja are considerably higher than experimental data at energies compared.

To resolve the above descrepancies, we also measured σ_t in the energy range between 3 and 3000 eV using a compact linear electron transmission apparatus. The apparatus consists of a hair pin type electron source, an electron lens system, a collision cell, a sub-collision cell, and a Faraday cup with a retarding electrode. The effective electron collision path length is estimated from the current received at the sub-collision cell. The forward scattered electrons in the collision cell are also estimated with the above currents. The inelastically scattered electrons are suppressed by the retarding electrode with appropriate potential which was set in front of the Faraday cup. Fig.1 shows the preliminary results where the forward scattered electrons were considered (corrected) and not considered (uncorrected), respectively. Even at low electron energies, such correction is not neglisible. Fig. 2 shows the present results were compared with those of typical results. In this measurement, the energy width of the incident electron beam is about 0.5 eV (FWHM). This character of the electron beam may introduce extra uncertainty in σ_t at lower energies than those at intermediate and higher energies. At intermediate energy region, the present results are higher than those of referred experimental data. The further detailed investigations are in progress.

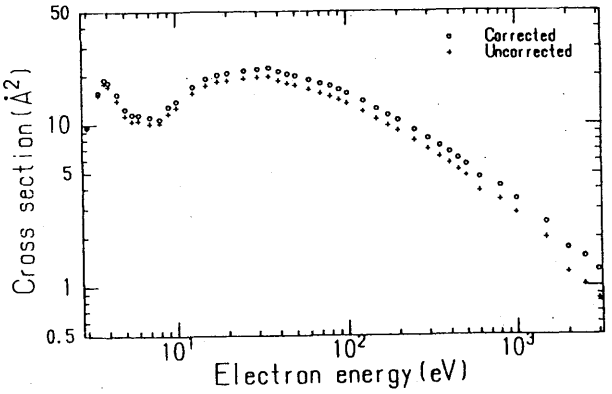

Fig.1. σ_t of CO_2 corrected by forward scattered electrons and those uncorrected v.s. electron energy.

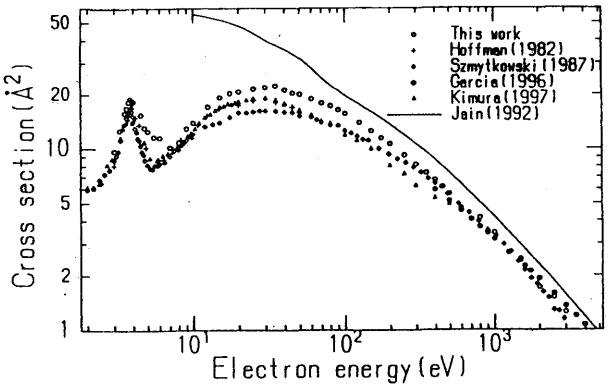

Fig.2. σ_t of CO_2 v.s. electron energy.

References

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2) Szmytkowski, Cz. *et al.*, J. Phys. **20** (1987) 5817.

3) Kimura, M. *et al.*, J. Chem. Phys. **107** (1997) 6616.

4) Garcia, G. and Manero, F., Phys. Rev. A **53** (1996) 250.

5) Jain, A. and Baluja, K. L., Phys. Rev. A **45** (1992) 202.