# High-resolution Measurements of Total Cross Section for Electron Scattering from Atoms and Molecules at Very-low-energy

**M. Kitajima[1], K. Shigemura[1], N. Kobayashi[1], A. Sayama[1], Y. Mori[1], T. Okumura[1], K. Hosaka[1], T. Odagiri[2], M. Hoshino[2], and H. Tanaka[2]**

[1]*Department of Chemistry, Tokyo Institute of Technology, Tokyo 152-8551, Japan*
[2]*Department of Material and Life Sciences, Sophia University, Tokyo 102-8554, Japan*

Accurate absolute cross section data for electron scattering from atoms and molecules provide important information not only for the fundamental physics of electron collisions but also for many fields such as electron-driven processes in the Earth and planetary phenomena, gaseous discharges, radiation chemistry and plasmas physics. Consequences of several interesting scattering phenomena such as Ramsauer - Townsend minimums, shape resonances, vibrational Feshbach resonances, and threshold structure due to a virtual state, appear in the scattering cross section curves especially at very-low collision energies, The low energy behaviors of the electron scattering cross sections are also related to the scattering length which gives zero-energy scattering cross section.

In the present report, absolute total cross sections for electron scattering from noble-gas atoms and some small molecules obtained with a technique employing the threshold-photoelectron-source combined with Synchrotron Radiation (SR) are presented. The technique makes use of photoelectrons produced by the photoioniztion of atoms using SR instead of using the conventional hot-filament electron sources [1-4]. In the present work, cross section measurements at very-low energies down to 5 meV with a high energy resolution were realized the in the single collision condition.

The measured cross sections for lighter noble-gas atoms, especially for He, agree very well with the theoretically obtained cross sections known as ‘standard’ [5-7] in the electron energy range down to 6 meV. On the other hand, heavier noble-gas atoms such as Kr and Xe were significantly smaller compared to the values reported by the previous swarm studies at energies below 100 meV. Comparison of scattering length for noble gas atoms obtained in the present work with those obtained in the swarm experiments also show systematic disagreement for heavier noble-gas atoms. Present high-resolution measurement also enabled to observe the structures on the total cross section curves of Feshbach resonances. Natural width of these resonances are also analyzed based on the spin-dependent resonant scattering theory. Total cross sections for electron scattering from some small molecules such as $H_2$, $N_2$ $O_2$, $CO_2$, and $N_2O$ will also be presented.

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